CHOOSING TARGET MARKETS FOR INNOVATIVE NEW TECHNOLOGY

Case: Biogas Company

LAHTI UNIVERSITY OF APPLIED SCIENCES
Degree programme in International Business
Thesis
Autumn 2010
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INKA HARTIKAINEN: Choosing target markets for innovative new technology
Case: Biogas Company

Bachelor's Thesis in International Business, 69 pages

Autumn 2010

ABSTRACT

This thesis deals with target market evaluation for a biogas company to be founded in near future.

The objective of this thesis is to outline potential target markets and investigate the validity of existing market intuition. Market potential is represented by the number of livestock farms and the biogas policies in selected countries. In addition, the aim is to build a basis for deeper market analysis.

The research is a case study. The empirical examination is made as a desk research, using secondary sources of data. The secondary data are interpreted against the context of the case company's needs and pre-assumptions. Support for the desk research was acquired by theme interviews with the commissioner. Due to the amount of target markets, the research was divided into two parts. In the first part, the markets were studied based on the number of livestock farms. For the second phase, three countries were selected. This phase concentrates on biogas policies and support mechanisms.

The three countries selected to the second phase of the study are Finland, Germany and Denmark. The findings show that the case company's market intuition is valid, and that all of the studied markets are prospective.

Though all of the markets have their potential, the author recommends further exploration of the domestic market as the next step. After that, the market knowledge can be expanded and foreign markets explored in more detail.

Keywords: biogas, feed-in tariff, innovation, market intuition, renewable energy, target market selection

Lahden ammattikorkeakoulu
Degree programme in International Business

INKA HARTIKAINEN:

Choosing target markets for innovative new technology
Case: Biogas Company

Opinnäytetyö

69 sivua

Syksy 2010

TIIVISTELMÄ

Tämä opinnäytetyön aiheena on kohdemarkkinakartoitus perustettavalle biokaasu yritykselle.

Työn tarkoituksena on kartoittaa potentiaalisia kohdemarkkinoita ja tutkia toimeksiantajan markkinaintuition luotettavuutta. Markkinoiden potentiaalisuuden määrittämisessä on käytetty valittujen maiden maatilojen lukumäärää ja biokaasukäytäntöjä, painopisteenä erilaiset tukijärjestelmät. Samalla on tarkoitus luoda pohja perusteellisemmalle markkina-analyysille.

Tutkimus toteutettiin tapaustutkimuksena kerätyn tiedon pohjautuessa jo olemassa oleviin tietoihin. Tutkimuksesta voidaan siis käyttää nimeä kirjoituspöytätutkimus, *desk research.* Tukea sekundääriselle tiedolle on haettu toimeksiantajan teema-haastatteluilla, joilla on selvitetty yrityksen tarpeita ja näkemyksiä työn eri vaiheissa. Kohdemarkkinoiden määrästä johtuen tutkimus jaettiin kahteen osaan. Ensimmäisessä osassa markkinoita tutkittiin pelkästään maatilojen lukumäärän perusteella. Maista kolme valittiin tutkimuksen toiseen vaiheeseen, jossa keskityttiin erityisesti tukijärjestelmiin.

Toiseen vaiheeseen valitut kolme maata ovat: Suomi, Saksa ja Tanska. Tutkimuksen tulokset osoittavat markkinaintuition pitävän paikkansa, jokainen tutkituista markkinoista voidaan määritellä prospektiiviseksi.

Case yrityksen suositellaan tutkivan kotimaisia markkinoita tarkemmin, jonka jälkeen jatkotutkimukset ja laajentuminen ulkomaille ovat ajankohtaisia.

Avainsanat: biokaasu, innovaatio, kohdemarkkinakartoitus, markkinaintuitio, syöttötariffi, uusiutuva energia

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ABBREVIATIONS

ARAC	All-Russian Agriculture Census
BAFA	German Federal Office of Economics and Export Control
BAT	Best Available Techniques
CHP	Combined Heat and Power
EU	The European Union
Eurostat	Statistical Office of the European Communities
FiT	Feed-in Tariff
GAIN	Global Agricultural Information Network
HACCP	Hazard Analysis and Critical Control Points
IEA	International Energy Agency
IPPC	Integrated Pollution Prevention and Control
kVA	Kilovolt Ampere
Mtoe	Million tonne oil equivalent
MVA	Megavolt Ampere (1 MVA = 1000 kVA)
MWh	Megawatt hour
NRES	Non-Renewable Energy Sources
RE	Renewable Energy
RES	Renewable Energy Sources
USDA	United States Department of Agriculture

1 INTRODUCTION

1.1 Grounds for the Research

Concern over the world's dependency on non-renewable fossil fuels as the primary source of energy is constantly increasing. As the amount of non-renewable energy sources is rapidly decreasing, the need for alternative and renewable energy sources is greater than ever. This has led to researchers, industry officials and government agencies aggressively investigating the use of alternative and renewable energy sources (RES) such as biomass.

The International Energy Agency has estimated the world energy demand to increase by 45 percent between 2006 and 2030. Two-thirds of the increase in world demand by 2030 comes from developing countries, especially in Asia. As can be seen from Figure 1, the current estimations of different energy source shares in final consumption 2030 are not ones to be pleased about. The consumption of energy in 2030 is assumed to be double the amount of 1990. At the same time, the increase in the share of RES is very small. (IEA World Energy Outlook 2008.)

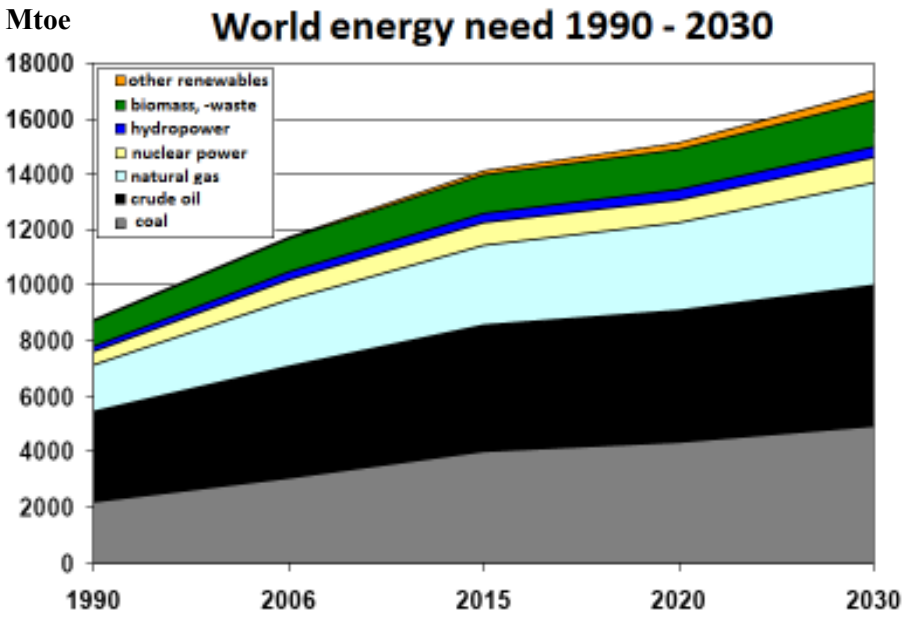

FIGURE 1. World energy need 1990-2030 (IEA World Energy Outlook 2008).

Energy production through biomass, which is abundant everywhere, is one of the most promising renewable energy options available because of its positive environmental implications. Biogas can be produced on farms from manure, field biomass and other organic substances. The gas can be used for heating, electricity production or transport fuels. (Bernhart 2007; Pellolta energiaa 2008). With biogas-technology, an environmentally sustainable society can be created. In an environmentally sustainable society the communal, industrial and agricultural bio waste is raw material for energy production, whether it is transport fuels, electricity or heat.

Biogas is formed when microbes degrade organic substances in anaerobic conditions. Decomposition results in a methane-rich biogas and digestion residues that can be used as organic fertiliser. Biogas is a mixture of gases, which usually contains about 40-70% methane, 30-60% carbon dioxide and very low amounts of, for example, sulphur compounds. Biogas is a valuable, renewable biofuel and energy source, which has significant environmental benefits. Methane, when freely released to the atmosphere, is a greenhouse gas 20-70% stronger than carbon dioxide. By reclaiming and utilising the formed biogas, the greenhouse gas emissions can be significantly reduced. (Finnish Biogas Association 2010.)

The opportunity to make this thesis about potential biogas markets was extremely pleasant for the author. This way the author could gain insight into some of the most interesting global issues at hand. Sustainable development and current energy trends and policies are of great personal interest as they affect the global development vastly. The world is now at a crossroads of making sustainable decisions, and it is exciting to observe the decisions governments and unions make worldwide.

1.2 Objective, Research Questions and Limitations

The objective of this thesis is to outline target markets for a biogas company to be founded in the near future. The research structure and objectives were decided in cooperation with the commissioner and for example, the markets to be studied were discussed in form of a theme interview in the early stage of the process. Therefore, no research questions are about the initial target market selection.

The main research question is thus:

1. What is the best target market for a biogas plant manufacturer?

Sub-questions made to ease the answering are the following:

1.1. What is the amount of livestock farms in the selected markets?
1.2. What are the biogas policies in the selected markets?
1.3. Do the market size and policies both support the market selection?

This thesis has some limitations that have been made in order to have control over the vast amount of available information. The study is a one-time market screening rather than a market analysis and thus more concise. The countries to be studied were pre-determined by the commissioner based on general interest and prospects, i.e. market intuition, which will be discussed more detailed in Chapter 2.6. Confidentiality imposes some restrictions, like the fact that the company and the product cannot be introduced in this paper. This has affected the formulation of the evaluations and conclusions, and some of the reasoning behind the recommendations had to be left out from the thesis.

Based on a theme interview with the commissioning company, a decision was made that this research is limited to deal only with, firstly, the amount of farms and the size distribution of agricultural farms (the market potential) and secondly, the policies of the selected markets. The policies include the biogas support schemes like feed-in tariffs and investment subsidies. The author recognises that for a thorough market analysis many more issues need to be studied in detail and no internationalisation decisions can be made solely relying on the results of this thesis.

1.3 Research Methods and Data Collection

Due to the nature of the study, qualitative methods are best suited to examine the subject. Qualitative research is the best approach when the aim is to study a particular subject in depth. It is good for exploratory research, when the topic is new and there is not much previously published material on the subject. (Myers 2009, 9.) Exploratory market research will be further discussed in Chapter 2.3 Market Research Approaches. Some features of a quantitative research are present in the form of statistical information in Chapter 3, but the data was gathered and analysed using qualitative methods.

The used method is case study. Yin (2003, 13-14) defines that a case study is an empirical enquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not evident. Yin continues that the case study enquiry copes with the technically distinctive situation in which there will be many more variables of interest than data points. He also states that case studies benefit from prior development of theoretical propositions to guide data collection and analysis. Myers (2009, 76) adds to the definition that in case study multiple sources of evidence are used, although most of the evidence comes from documents and interviews.

The first part of Yin's definition, the real-life context means in this case that the studied markets are not separate from the context of this research. Even though the market-data are unvarying per se, it is interpreted against the context of the case company's needs and pre-assumptions. Yin also encourages to the using of theoretical propositions from the literature to guide the research. The fulfilment of this aspect can be seen from this chapter and the theoretical framework.

The definition of Myers is concerned with the data collection method. In this thesis, the used data collection technique is to use secondary data, and more specifically, documents. In other words, the research is mostly done as a desk research. This choice of method was made because market data about the subject in hand would be inconvenient to gather by observation, conducting fieldwork or doing interviews. In addition, the policy aspects are such in nature that they are

better to be interpreted based on actual Acts than on hearsay. The use of secondary data in market research is further discussed in Chapter 2.5.

Information to support the research process was gathered by conducting theme interviews with the commissioner. Myers (2009, 124) has defined theme interview as an unstructured interview, in which the exact form and order of the questions is left open. Only the themes and rough questions have been made beforehand. The situation resembles a normal conversation. These theme interviews have brought new perspective to the research and have given a strong background for the implementation of the study.

1.4 Structure of the Thesis

This thesis is constructed of two main parts that are the theoretical and empirical parts. The introductory part describing the background, objectives, limitations and methodology of this thesis, precedes the theoretical part that can be found from Chapter 2 of the thesis. This chapter constructs the theoretical framework and discusses market analysis and market selection on a more general level.

The empirical part of the thesis consists of Chapters 3 and 4. Chapter 3 presents the market size distribution of the selected markets, answering to research question 1.1: “What is the amount of livestock farms in the selected markets?” Chapter 4 is based on research question 1.2: “What are the biogas policies in the selected markets?” and describes the operational environment regarding market-specific support mechanisms.

Chapter 5, Conclusions & Recommendations answer to research question 1.3 “Do the market size and policies support each other?” and tie all the previous chapters together. In addition, recommendations for the commissioning company are made, and thus the main research question, “What is the best target market for a biogas plant manufacturer?” is answered. The last chapter summarizes the main aspects and key findings of the thesis. The Summary is then followed by the list of References and the Appendices.

2 MARKET RESEARCH AND SELECTION

This part of the thesis concentrates on the practice of conducting market research and implementing the results in the market selection. The theories presented in this part build up the theoretical framework of the thesis. The first five subparagraphs discuss market research and the various aspects involved. The latter three subparagraphs are involved with target market selection, with special emphasis on high-tech innovations.

2.1 Why Do Market Research?

The objective of doing market research is to find information that helps in decision-making. Market analysis needs data as well as interpreted information that is formed by combining internal and external data. Global innovators are very dependent on sundry information and the control over it. They need information on markets, competitive situation, clients and products. Developing new products demands a lot of both tacit and explicit knowledge. Keeping the information up to date is part of the challenge. Predicting future using both traditional and new methods is advisable. (Lotti 2001, 26-27.)

The global business environment includes various components, which have an effect on how to operate in that particular environment. These components include political, economic, social, technological, environmental and legal factors. The market environment is worth studying and analysing when choosing target markets and well before going into international business. (Karhu 2002, 12-14.)

The target markets should be examined both on national and international level, as well as focusing on specific regions or segments in the selected countries. The selection of internationalisation mode is affected by the company strategy, size, resources and product. Noteworthy issues are also the business field, markets and possible restrictions on foreign trade. (Seristö 2002, 101.)

For many firms in the B2B technology markets the idea of market research is questionable. In these high-tech markets, innovation is believed to be the key success factor. A large amount of empirical research on success and failure in new product development supports the idea that market research is essential if new products are to succeed. Successful new products tend to be those backed by an early, extensive, diverse and proficient market research. (Jackson 2007, 35.)

The utility of market research is often thought to be most questionable in the context of true, new-to-the-world innovations. Two models of the invention process can be distinguished: "technology push" and "demand pull". In the technology push model, you would hire bright people, lock them into a lab and wait for insanely great products to emerge. In the demand-pull model, you would first identify an unsolved customer problem and then direct the inventive efforts of those same scientists and engineers toward solving that problem. Research has shown that 70 % of successful innovations fit a demand-pull model. (Jackson 2007, 35-39.) Successful companies in high-tech markets do market research and collect information to guide decisions.

2.2 Market Research in Practice

The International Chamber of Commerce (2008, 5) has defined market research as the systematic gathering and interpretation of information about individuals or organizations using statistical and analytical methods and techniques to gain insight or to support decision-making. Keegan & Green (2010, 210) add to the definition that market research is any organized effort to gather information about markets or customers. It is a project-specific systematic gathering of data and a very important component of business strategy. Information is a critical ingredient in formulating and implementing a successful market strategy. The term market research is commonly interchanged with marketing research; however, marketing research is concerned specifically about marketing processes, while market research with markets.

In global market research the process is done on a global scale. The challenge of global market research is to recognise and respond to the important national differences that have an effect on how information can be gathered (Keegan & Green 2010, 210). Czinkota & Ronkainen (1994, 27) have identified four specific factors that may require global research efforts to be implemented differently than in domestic research. First, there might be new, different parameters of doing business. There might, and most likely will, be different requirements, but also the way the rules are applied may differ a lot. Second, the culture shock –effect should not be underestimated. Third, a company entering more than one new geographical market may come across a burgeoning network of interacting factors. Fourth, the researchers may have to broaden the definition of competitors in international markets to include competitive pressures that would not be present in the domestic market.

Keegan & Green (2010, 210) suggest that there are two basic ways to conduct market research. One is to design and implement an in-house study; the other is to use an outside expert firm to do the research for you. When doing global research, a combination of in-house and expert research is often the best choice. Many expert companies have considerable international expertise and some specialize in particular industry segments.

2.3 Market Research Approaches

The choice of research approach is based on two simple principles: repeatability and accuracy. Regarding repeatability a decision has to be made whether the aim is to produce information on:

- nonrecurring,
- repeated or
- continuous basis.

If the study in question is meant to be nonrecurring, the research design can exclude comparability over time or regionally. Repeated measuring means for example that a focus group is examined on yearly basis. It is essential for the data

to be comparable, so the changes can be identified. Continuous research on the other hand focuses on a constant group of individuals, economies or companies that are measured all the time. This allows an interchangeable data analysis between a change and marketing procedures, for example. (Lotti 2001, 108.)

The other criterion is the needed accuracy of information. The research approach can be:

- exploratory,
- descriptive or
- explanatory.

Exploratory research, like this thesis, can be quite informal. It is based on existing information from statistics, internet, organisations, and might include a few expert interviews. It is often referred to as desk research. It can also be a preliminary research, with no repetitive intentions. A typical research of this type is a new export market screening. In descriptive studies the information is gathered using systematic interview techniques and target group sampling. Measured items are opinions, attitudes, values and brands, to mention a few. The explanatory approach is the most demanding. It is used to measure which influences what, and how. An example of explanatory approach in market research is the use of panels, a fixed group of respondents, whose behaviour is followed. (Lotti 2001, 108.)

2.4 Market Research Process

The information for different parts of a market analysis is gathered mainly using the market research methods. In addition the already existing internal information, statistical data and information from various databases can be utilised. The ingredients of market research are rarely ready-to-use and available. However, the gathering process can be started gradually, starting from a specific part or parts completing the whole research with time. Market analysis is based on multiple continuous or repetitive measuring processes. One continuous process is the market and market share surveying. Another is measuring customer relations and customer satisfaction. Information regarding the business environment is gathered

and updated continuously. Finally all this information, and much other, is examined together with financial key figures. (Lotti 2001, 105.)

Some fundamental issues regarding the research process should be clarified from the start:

- defining the objectives: what information, what for, for whom
- need for information: continuous, repetitive
- existing knowledge: what, where, exploitability
- choosing researcher (in-house or outside), partners and contact persons
- research design, implementation, resources, budget, schedule
- collecting and processing information
- data exploitation; who and where
- updating data, how often

If the research is done as an outside study, the commissioner and researcher are both part of the process. The parties should agree on authorisations and responsibilities and draw a contract that clarifies these issues. (Lotti 2001, 107.)

Research studies evolve through a series of steps and the process of collecting data and converting it into useful information can be quite detailed. The following Figure 2 demonstrates the flow of marketing research process. The process flowchart and its contents are further discussed in the chapters to follow. The figure and its explanations are based on the Keegan & Green publication: Global Marketing.

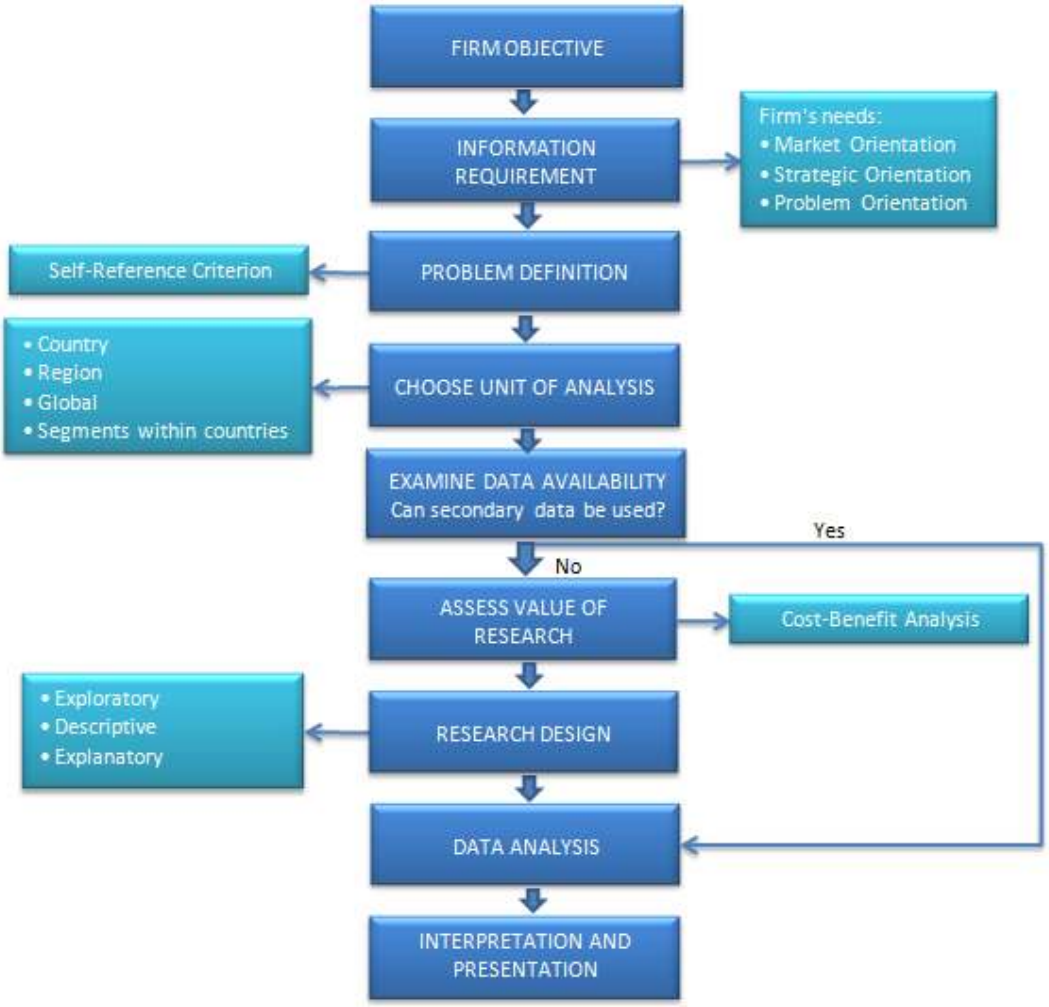

FIGURE 2. Market Research Process (Keegan & Green 2010, 213; Aaker et al. 2006, 49).

Keegan & Green (2010, 213) unravel the figure step-by-step. The first step, information requirement means that a problem or opportunity has been identified and thus formal research is undertaken. A company may need to supplement direct perception with additional information to determine whether a regional market offer good growth potential. Regardless of a particular subject in hand, the first two questions a researcher should ask are "what information do I need?" and "why do I need this information?"

Step 2, problem definition. When approaching global markets, it is best to have "eyes wide open". When a person's values and beliefs affect the assessment of a foreign culture or country, the self-reference criterion (SRC) is at work. The SRC

tendency highlights the importance of understanding the cultural environments of global markets. The researchers and marketers need to be aware of the impact SRC and other cultural assumptions and prejudices can have. (Keegan & Green 2010, 214.)

Choosing the unit of analysis, step 3, involves the need to identify in what part of the world the company should be doing business and finding out as much as possible about the business environment in the area identified. The unit of analysis may be a single country or a region such as Europe. Countrywide data, however, is not always required for all market entry decisions. A specific city or province may be the relevant unit of analysis. In this particular research, the unit of analysis is country. (Keegan & Green 2010, 214.)

The first task at step 4, "examine data availability", is to answer several questions regarding the availability of data. What data should be gathered? Can secondary data be used? These issues must be addressed before proceeding to the next step of the research process. Using readily available data saves both time and money. A low-cost approach begins with a desk research, using secondary data, like this thesis. Personal files, libraries, online databases, government records and trade associations are some of the data sources that can be tapped with minimal cost and, in the best case, effort. If secondary data are available, the researcher can move on to data analysis without implementing steps 5 and 6. (Keegan & Green 2010, 216.)

Step 5 is to assess the value of the research. When data are not available through published statistics or studies, management may wish to conduct further research on the market. However, collecting information costs money. Thus the research plan should indicate the worth of wanted information compared with the cost of collecting it. It is necessary to perform a cost-benefit analysis before proceeding further. The small markets around the world pose a special problem for a researcher. The relatively low profit potential in smaller markets justifies only modest expenditures for research. It may be necessary to use inexpensive survey research that sacrifices some thoroughness to achieve results within a smaller research budget. (Keegan & Green 2010, 218.)

As in the figure, the researcher can go directly to the data analysis step if secondary data can be used. If, however, the information is not available from published statistics or studies and cost-benefit analysis is positive, a research design (step 6) should be established. This means that primary data are gathered through original research addressing the particular problem identified in step 1. In global research it is advisable to use a mix of techniques, such as surveys, interviews and brand analysis. (Keegan & Green 2010, 218.)

The data collected up to this point, data analysis (step 7), must be subjected to some form of analysis for it to be useful for management. The data analysis is of more importance with primary data. First, the data must be prepared before further analysis is possible. The analysis continues with tabulation, that is the arrangement of data in tabular form. Researchers can also use various statistical techniques such as hypothesis testing and chi-square testing. If interaction between variables is of interest, interdependence techniques such as factor analysis and cluster analysis can be used. However, if the research is done using secondary data, these techniques do not suit the purpose, and the results are more interpreting the data, than analysing it. (Keegan & Green 2010, 225-229.)

Keegan & Green (2010, 230) have defined the eighth and final step as the interpretation and presentation. The market research report must be useful to managers as input to the decision making process and it must clearly relate to the problem or opportunity identified in step 1. Many managers are uncomfortable with research jargon and complex quantitative analysis, thus the results should be clearly stated and provide a basis for managerial action. Implementation of this step can be seen from the analysis chapters and from the conclusions.

2.5 Secondary Data in Market Research

The empirical part of this thesis is based on using secondary data and thus issues related to that are covered in this chapter. Secondary data could be defined as data

that was collected originally for purposes other than solving the problem at hand. This is one of the cheapest, and in some cases easiest, means of accessing information. Thus the first thing a researcher should do is to search for available secondary data. The amount of secondary data can be overwhelming and researchers need to locate and utilize the data that is the most relevant to their research. (Aaker et al. 2006, 110.) The following Figure 3 illustrates the various sources of secondary data. The area surrounded with a red line demonstrates the data sources most used in this particular research.

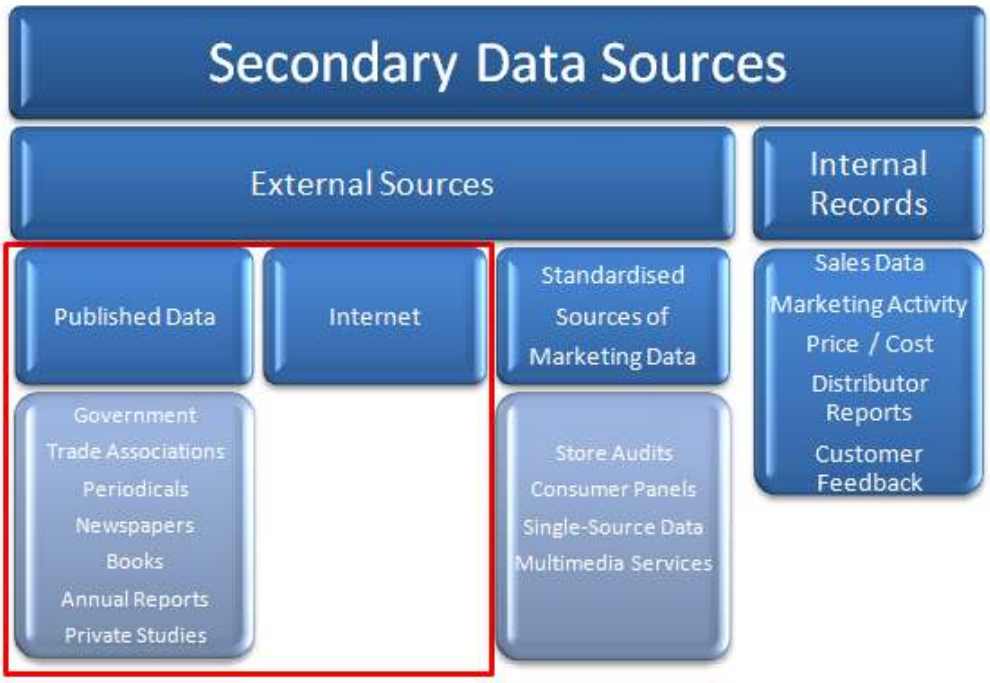

FIGURE 3. Secondary Data Sources. (Aaker et al. 2006, 110)

Aaker, Kumar & Day (2006, 111) continue that researchers can use secondary data in various ways. First, it is good to recognise that secondary data may provide enough information to resolve the problem being investigated. Secondary data can also be a valuable source of new ideas that can be later explored using primary research. Examining available secondary data is prerequisite for collecting primary data. It helps to define the problem and formulate hypotheses about its solution. Usually it provides a better understanding to the problem and the context may help to find new solutions.

The most significant benefits of using secondary data are the savings in money and time. Even if the data are bought, it will probably turn out to be cheaper than collecting primary data. Some research projects may not be feasible for the company and in such cases; use of secondary data is the only solution. For example, if a company needs certain information on the entire population of Great Britain, it will be neither physically nor financially possible for the company to obtain it. Historical information is always secondary data. If a company wants to find out past market trends, for example, it cannot conduct a primary research. In some cases the secondary data may even be more accurate than primary data. Competitor analysis is one example; government-released information can be more reliable than information collected by interviewing the competitors. (Aaker et al. 2006, 111.)

Aaker et al. (2006, 112) state that despite the many potential benefits of secondary data, there are also a number of limitations. Secondary data are data that have been collected for other purposes in the past. Thus there might be problems of fit; the available data may have a different unit of measurement from what is required, for example. Even if the units of measurement are same, there still might be differences in class definitions. Secondary data may also be outdated and thus cannot be used in current research. As the time from data collection to publishing is often long, the data can be outdated already when first available.

2.6 High-Tech Innovations

High-tech environments are burdened with change and uncertainty. Potential customers have difficulties envisioning how new technology can meet their needs. They might not even be aware of the needs they have. In this market environment companies must accelerate their product development process, minimising the time between the idea and market introduction. Successful companies in high-tech markets do market research and collect information to guide decisions. (Mohr et al. 2005, 134.) As Figure 4 shows, the research methods must be aligned with the type of innovation being developed.

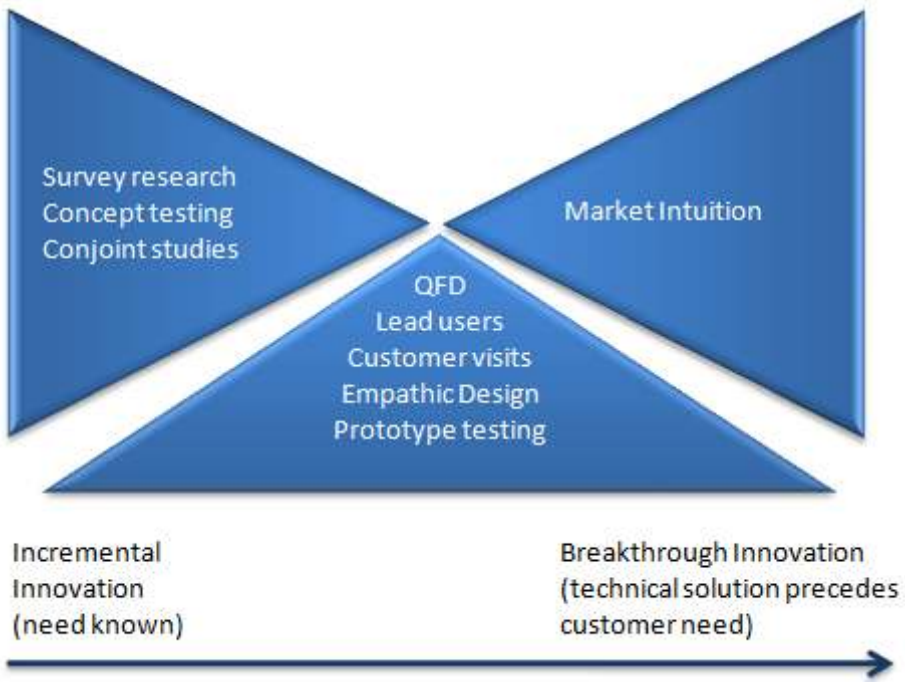

FIGURE 4. Aligning market research with type of innovation. (Mohr et al. 2005)

For incremental innovations, new product developments are in alignment with the current market. Customer needs are generally known, and traditional marketing research can help firms to understand the needs. The traditional marketing research tools are most effective when the product is well understood by the customers or the customer is familiar with possible solution because of related previous experience in other contexts. (Mohr et al. 2005, 135.)

However, standard market research techniques do not typically address new uses or new benefits and are less effective when customers are unfamiliar with the product being researched. Thus these standard techniques might not provide useful information for breakthrough products or rapidly changing markets. In the extreme, where technical solutions precede customer needs, market research might consist largely of guided intuition. In this case, industry experts may be helpful and the creation of different future scenarios can be used to guide the decision-making based on intuition. (Mohr et al. 2005, 135.)

Slater, Hult and Olson (2007, 7) discuss the performance impact of strategic behaviour and market targeting in the context of business strategy. They present two dominant frameworks of business strategy: the Miles & Snow typology and the Porter typology. Miles & Snow developed a comprehensive framework that deals with organisational approaches to product-market fields and how companies construct processes to achieve competitive advantage in those fields. They identified four archetypes of how firms address these issues: Prospectors, Defenders, Analysers and Reactors.

Prospectors seek to locate and exploit new product and market opportunities while Defenders attempt to isolate a market share in order to create a stable product and customer sets. Analysers follow prospectors to new product-market fields while protecting their existing product and customer sets. The Reactors do not have consistent response to the entrepreneurial problems. According to Porter typology, strategy is a product of how firms create customer value and how they define the scope of market coverage. Slater & Olson have studied these strategies and developed these typologies further. The following paragraph introduces the Slater & Olson definition of Prospectors. (Slater et al. 2007, 7.)

From the four strategy types, Prospectors are the most proactive and innovative. Exploration of new opportunities is a central theme for these innovation-driven companies. Exploration can be in the form of “outside-in” processes, that is customer-oriented behaviours, or in the form of “inside-out” processes, which are purely research and development driven innovations. Using traditional research tools (e.g. surveys, focus groups) or solely listening to customers can restrain innovation. This can lead to the creation of safe, but bland offerings because the innovation process has been dictated by ideas that customers can envision and articulate. With new breakthrough innovations, this is a problematic issue as, like already discussed in the previous paragraphs, customers are not always aware of the needs they have, or not able to articulate the needs they do identify. Thus the new product development of the Prospectors could be supported by observing customer’s use of products in normal routines, or by working closely with lead users who recognise a need in advance of the market majority. (Slater et al. 2007, 7.)

A generally subscribed assumption that innovations arise from developments in technological knowledge exists in evolutionary economics. The high-tech innovations create new market opportunities simultaneously transforming demand in many existing product markets. According to this view, the market primarily influences selection among competing technologies and the course of the technology after its adaptation. Thus the technological orientation should be positively related to success for Prospectors, since R&D frequently drives the development of radical innovations. Prospector firms should pay attention to the orientation of different departments; marketing communication should be technologically oriented while the R&D should be customer-oriented when creating new products and developing core technologies. (Slater et al. 2007, 8.)

In addition to that, when transforming innovative technologies into products, Prospectors may not even be able to identify their competitors or potential competitors. Thus, the Prospectors should focus more on customers and technology, which continuously pushes product and market boundaries, than on competitors. As the strategic orientation is to pursue new product and market opportunities, Prospectors should target the innovator and early adopter segments. Buyers of these segments do not require comprehensive solutions to their problems and Prospectors generally are neither totally effective nor efficient in providing total customer solutions. (Slater et al. 2007, 8.)

2.7 International Market Selection

When choosing target markets, the company should examine the potential target market in depth. Market research helps the company to find out relevant information of the country and to decide whether to start operations there or not. The aim of market research is to bring the company knowledge that will strengthen its potential to succeed in the foreign markets. (Pasanen 2005, 19.)

One of the most important decisions a company has to make regarding internationalization is the selection of target markets. Two main decision making

models can be identified, the first is the opportunistic approach and the second is the systematic approach. Opportunistic approach is often used by companies with little knowledge on international business. The target market selection is greatly affected by tacit knowledge, i.e. knowledge that is difficult to transfer to another person by means of writing it down or verbalising it. The selection is made based on personal feelings or experiences, or perhaps the company has received enquiries and therefore "knows" that demand exists in that country. (Vahvaselkä 2009, 66.)

The second, more organised decision making model is the systematic approach. The systematic approach involves the use of explicit, hard knowledge. In this model, the company analyses the potential target markets first in the macro-level, and then progresses to micro-level and sales potential analysis. The markets with most sales potential are tested and suitable target markets are selected. Macro-environment is the external factors that affect the company, but to which they cannot influence. These factors are such as political factors, legislation, technology and infrastructure. The microenvironment includes the factors, to which the company can have an impact on, to some extent, like marketing, demand and competition. (Vahvaselkä 2009, 66.)

Alexander, Rhodes & Myers (2007, 424) state that many market selection decisions are characterised by a non-systematic, strongly personalised and belief driven selection process, rather than a process that relies on a rational basis. While the rational selection is presumed to be a distinguishing aspect of research on market selection, the irrational choice of markets based on non-systematic criteria may be more influential and deterministic. Market research processes are usually systematised in organisations but the mere existence of these structures do not necessarily determine the final decisions.

2.8 Impact of Distance Factors

Researchers in international marketing have long examined the impact of distance factors, such as culture and geographic, on firms' selection of target markets. Some researchers find that cultural and geographic distances have a significant impact on firms' decisions to select international markets, while some find no impact of cultural and geographic distance.

Malhotra, Sivakumar & Zhu (2008, 652) argue that the mixed findings may be caused by the fact that the effect of distance factors on target market selection is contingent upon the market potential of the target country. Specifically, they address the issue whether the effect of distance factors on firms' selection of target markets is influenced by the market potential of the target country. The distance factors are measured by cultural, administrative, geographic and economic (CAGE) distances. Target country's market potential has been found to be among the most important determinants of foreign direct investment and is considered an important contingency variable influencing international strategy decisions.

Broadly, in the CAGE framework, cultural distance refers to differences in social norms, language and beliefs between the two countries. Administrative distance refers to differences in bureaucratic, working, and political structure prevalent in the two countries. Geographic distance refers to the actual distance in kilometres between the countries. Finally, economic distance refers to differences in economic conditions between the two countries. (Malhotra et al. 2008, 654.)

Malhotra et al. (2008, 653) propose that managers will undertake market entry decisions based on a trade-off between risks and returns; while distance factors pose a risk to managers, market potential represents opportunities or returns. Thus, if the market potential is large, managers may be willing to take risks by targeting countries that are at larger distances. In the study, they express the risk factors as distances between the home and the target countries. Cultural and geographic distances are generally considered sources of risk. The larger the

distance between the countries, the greater the uncertainty and the costs firms will have to face in overcoming and integrating these distances.

The research suggests that firms prefer to target markets that have a similar culture and that are closer in distance to their home country. In addition, market potential of the target country significantly moderates the affect of distance factors: for target markets with higher potential, firms are willing to overlook the importance of distance factors. The results of the Malhotra, Sivakumar & Zhu model clearly indicate that the distance between the home and the target country influences the internationalisation behaviour of firms. The results show that the large market potential of countries compensates and even overrides the role of distance. Management should not be motivated entirely by the potential benefits of investing in countries that are closer in distance and have similar cultural beliefs, but rather should pay close attention to how large these markets are for their products and/or services. (Malhotra et al. 2008, 666-668.)

3 CHOOSING TARGET MARKETS: MARKET SIZE

This chapter of the thesis presents the first phase of the target market research. For this first phase, the markets were selected based on a theme interview with the commissioner in an early stage of the process. The selection of these countries to be studied was purely based on market intuition, which is discussed in more detail in Chapter 2.6 High-Tech Innovations. The countries are gone through one-by-one. The amount of farms was selected as one subject of the research, because the farms represent the customer potential of each country.

3.1 Farm structures

The selected markets are Finland, Denmark, Germany, Netherlands, Russia, Ukraine and the USA. Each of these countries will be individually reviewed from the statistical point-of-view in this chapter. As the farm structures and the number of farms vary from country to country, the figures have not been made using the same data points. The unit of measurement for market size is the number of cattle, pig and poultry farms by number of animals, in other words the farm structures in the selected countries. All of the figures for different countries are presented in the same order: first the cattle farms, second the pig farms and lastly the poultry farms.

3.1.1 Finland

Around 5.4 million people reside in Finland, with the majority concentrated in the southern region of the country. It is the eighth largest country in Europe in terms of area and the most sparsely populated country in the European Union. In 2009 there were 64 175 farms in Finland: 1 600 farms had discontinued production compared to the previous year. Close to 40% of the farms that discontinued production had not applied for subsidies. The average arable area of Finnish farms in 2009 was about 36 hectares. During the same year, the average age of farmers exceeded the 50-year milestone, though farmers around the age of 30 had farms with the largest arable area. (Matilda 2010.)

The biggest production sector in Finnish agriculture is cereal production with about 43 per cent of total agricultural production. Of the total production, milk production and other cattle husbandry counts for 19%, pig husbandry for 3.5 % and poultry husbandry for only 1%. (Matilda 2010.)

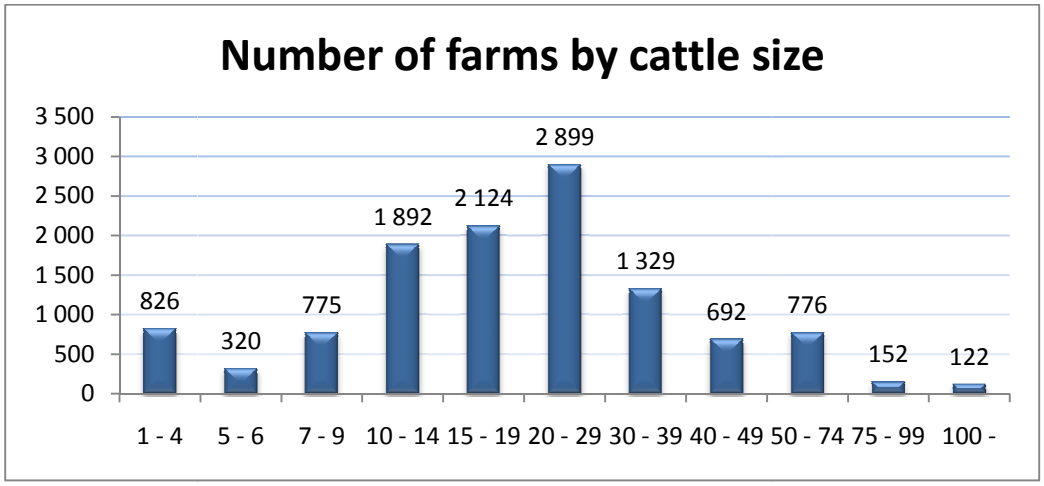

FIGURE 5. Finland: Number of farms by cattle size 2008 (Maatilatilastollinen vuosikirja 2009)

Figure 5 describes the structure of Finnish cattle farms. From the figure, we can see that in 2008 there were approximately 12 000 cattle farms in Finland. The greatest market potential lies in farms of quite small herd size; farms with 10 to 40 cows. In the international context, these size classes are very small.

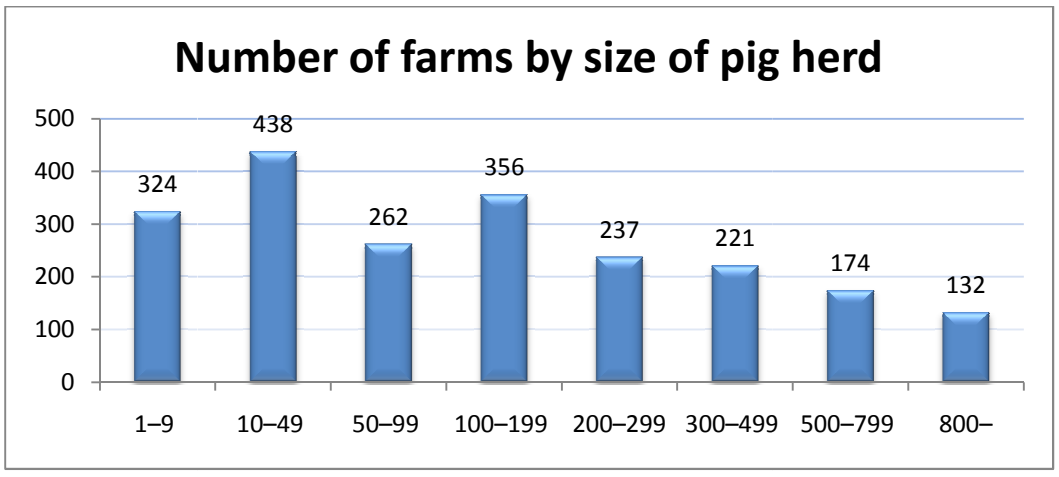

FIGURE 6. Finland: Number of farms by size of pig herd 2008 (Maatilatilastollinen vuosikirja 2010)

Figure 6 presents the pig farm structure. In 2008 the number of pig farms in Finland was 2 144 farms. Most of these farms have herds smaller than 200 pigs. As with the cattle, these farm sizes in the international context are small.

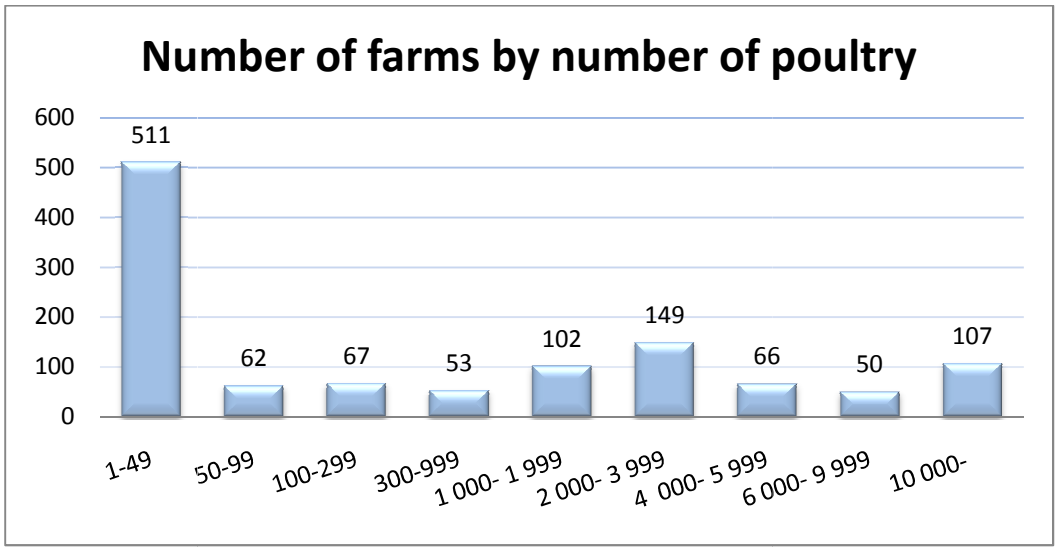

FIGURE 7. Finland: Number of farms by number of poultry 2008 (Maatilatilastollinen vuosikirja 2009).

The number of chicken farms is the smallest of the three farm types, as can be seen from the Figure 7. In 2008 there were only about 1 000 poultry farms operating in Finland. Almost a half of these farms have less than 50 chickens. If we think about the biogas raw-material potential of farms of this size, it is not considerable.

3.1.2 Denmark

Denmark is the only country in the Baltic region with a net export of agricultural products, producing three times the amount of food it needs for own consumption. A good percentage of arable land and moderate climate has been favourable to agriculture, but the sector's extremely advanced technology and infrastructure are what have made it so productive in recent years. In 2009 there were 41 384 farms in Denmark. Family-run farms are still dominant in Denmark with some 91 per cent of farms being family-owned and run, seven per cent company-owned, and

the rest owned by the state, local authorities and foundations. Along with increasing farm size, the typical farmer has to concentrate on one sole branch of farming, and specialization in animal production has led to fewer types, but larger numbers, of livestock. (Danish Agriculture & Food Council 2010.)

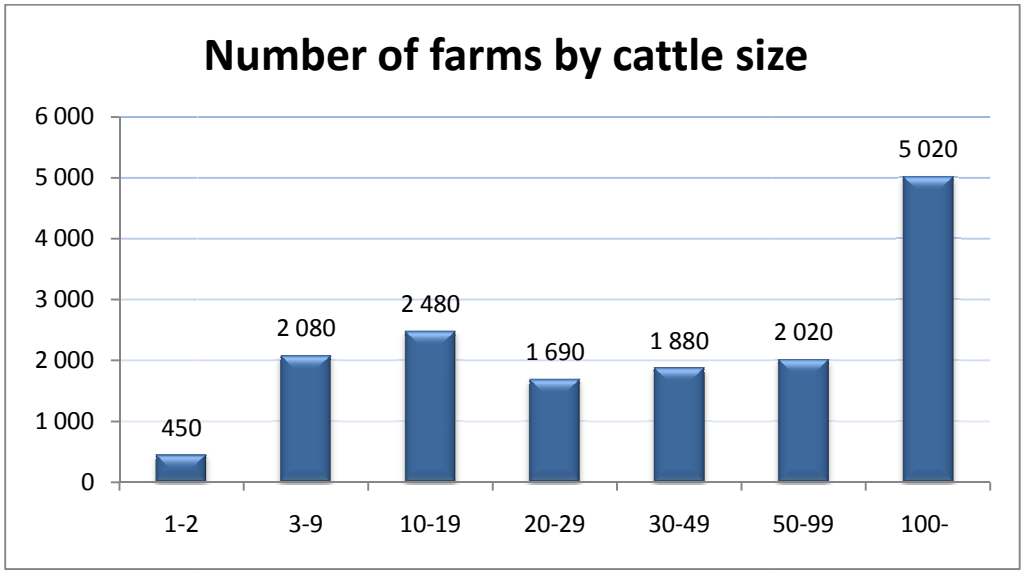

FIGURE 8. Denmark: Number of farms by cattle size 2007 (Eurostat 2010).

In 2007, there were approximately 15 600 cattle farms in Denmark. As can be seen from Figure 8, one third of these farms have herds bigger than 100 cows. There is also a large amount of small farms with smaller herds than that. Overall, the size distribution of Danish cattle farms is quite even.

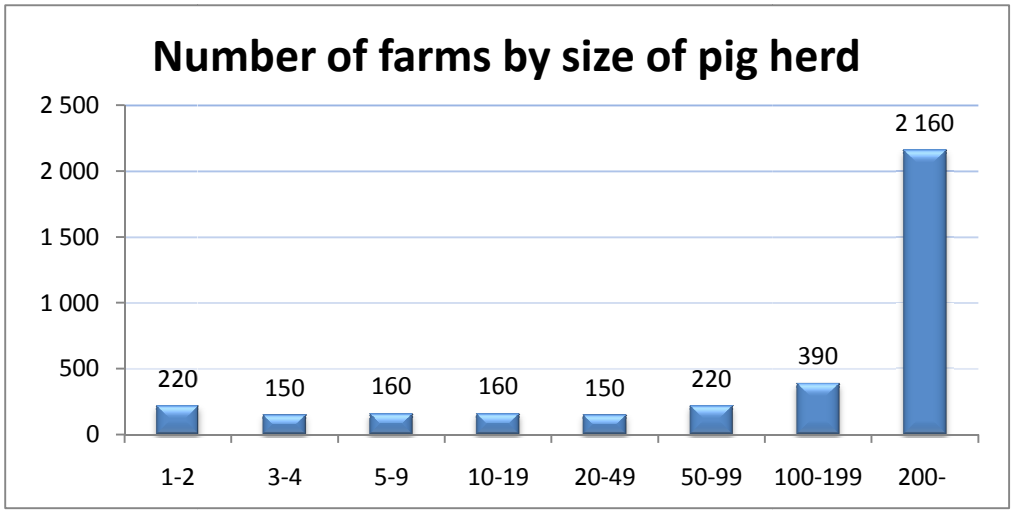

FIGURE 9. Denmark: Number of farms by size of pig herd 2007 (Eurostat 2010).

Like in Finland, the total number of pig farms smaller than the number of cattle farms. Figure 9 demonstrates the size distribution of these farms. Most of the Danish farms have bigger pig herds than 200 animals. The total number of these farms is 3 600.

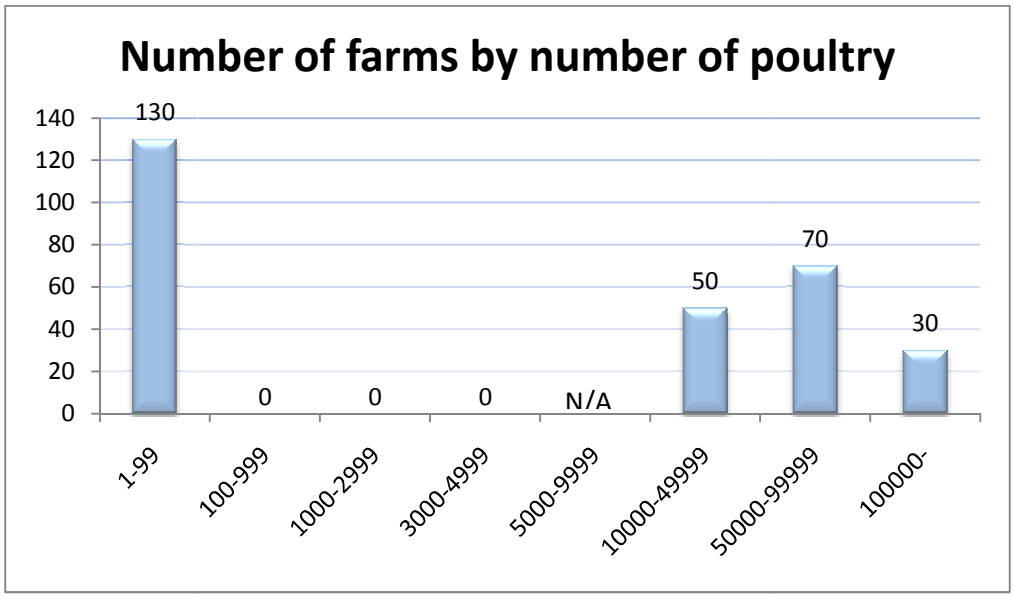

FIGURE 10. Denmark: Number of farms by number of poultry 2007 (Eurostat 2010).

The reliability of the statistical information about Danish poultry farms is somewhat questionable. Based on the data in Figure 10 there were only 280 chicken farms in 2007. What is more peculiar, is the fact that according to the data there were no farms with 100 - 4 999 chickens, and the data of the fifth size class has been not available. Based on these notions, the Danish chicken farms will be excluded from further analysis.

3.1.3 Germany

Germany is among the largest agricultural producers in the European Union. More than half of Germany's 19 million hectare territory is used for farming. The average arable land of German farm is 43 hectares. Around 1.25 million part-time or full-time workers produce goods worth approximately 40 billion Euros on 370 000 farms. Most the farms, 94 per cent, are run by individual enterprises, 4.7% by

partnerships and the remaining 1.3% by legal persons under private and public law. In individual enterprises, the farm operator and family members usually contribute a large part of the labour output. (BMELV 2010.)

Germany is the largest pig-meat producer in the EU, accounting for almost 20 per cent, and the second largest producer of beef and veal, accounting for 16 per cent. The size structure of livestock populations in Germany differs greatly from region to region. Milk production is the most important pillar of German agriculture, making up over 20 per cent of the output value. (BMELV 2010.)

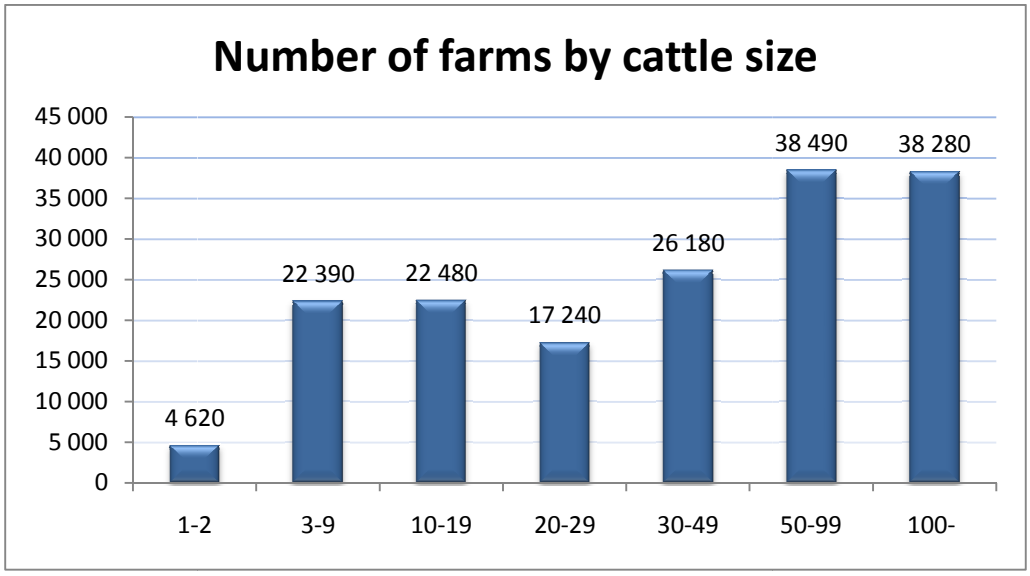

FIGURE 11. Germany: Number of farms by cattle size 2007 (Eurostat 2010).

In 2007 there were astonishing 170 000 cattle farms in Germany. From the Figure 11, it can be seen that almost a half of these farms are bigger than 50 cows in cattle size. To put the amount of farms to context: in Finland, the total number of cattle farms was 12 000, which is less than half of German farms with cattle size fewer than 10.

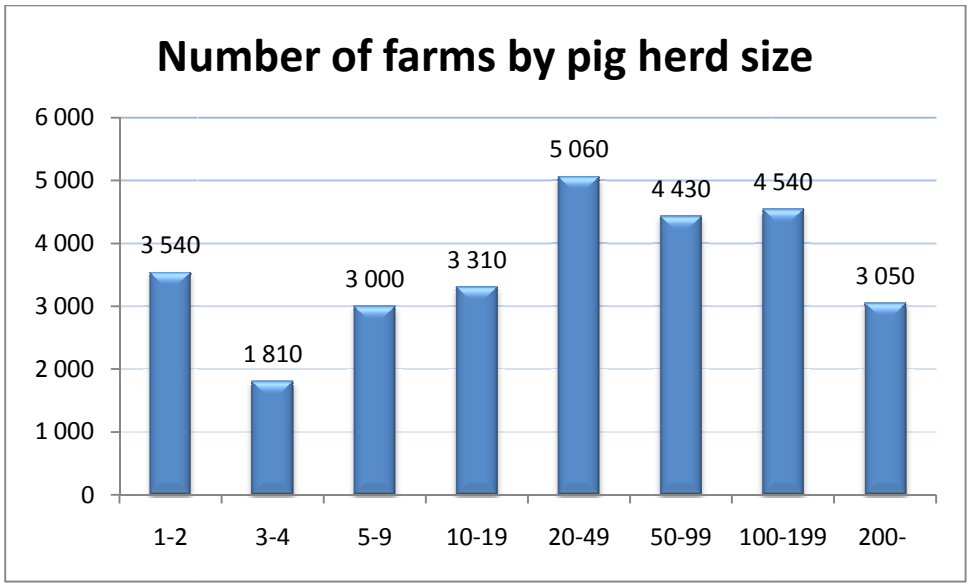

FIGURE 12. Germany: Number of farms by pig herd size 2007 (Eurostat 2010).

The number of pig farms is also quite remarkable, 28 740 farms. As can be seen in Figure 12, the size distribution of pig farms is more even than the cattle farms. The amount of German pig farms is over ten times the amount of Finnish pig farms.

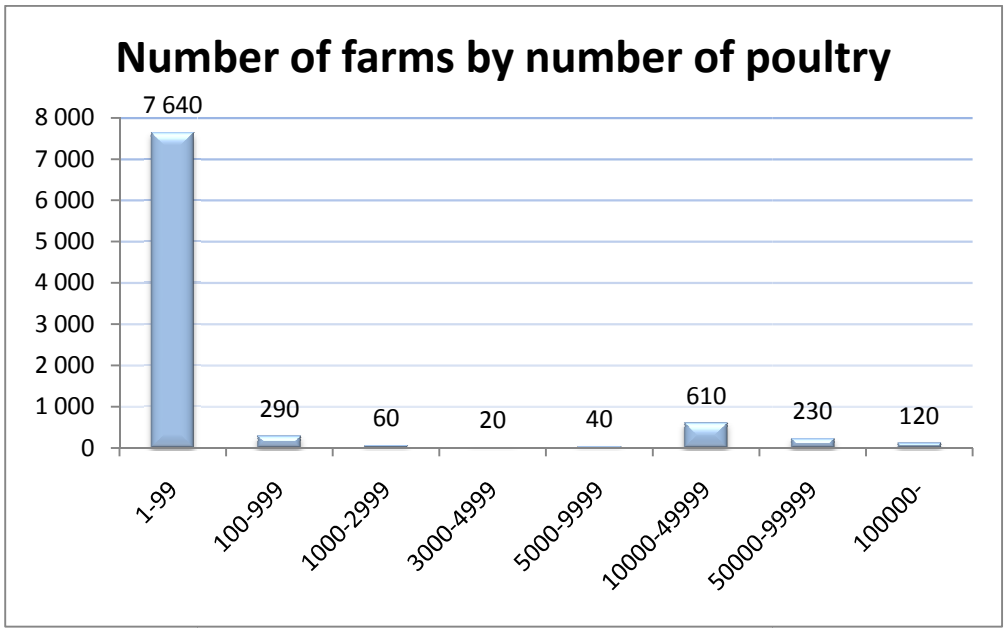

FIGURE 13. Germany: Number of farms by number of poultry 2007 (Eurostat 2010).

As with Denmark, the German poultry farm statistics in Figure 13 do seem a bit questionable at first glance. The size distribution is very uneven, being that farms with less than 100 chickens counts for 85% of all the poultry farms. When comparing the data to other countries, it however seems that it is more of a rule than an exception that the amount of farms decreases while the size increases.

3.1.4 Netherlands

Arable farming and horticulture play an important role in the Dutch economy. The Netherlands is among the world's three largest exporters of agricultural products next to the United States and France. The Netherlands exported agricultural products worth 65 billion EUR in 2008, which account for 17.5% of the total Dutch exports that year. Agricultural exports go largely to other EU Member States. Agricultural imports to the Netherlands are also sizable: 41 billion EUR in 2008, for nearly one-eighth of total imports. (The Dutch agricluster in a global context 2010.)

The trend in Dutch agriculture has been a slight expansion and intensification of production, rising productivity and restructuring of farms. Between 1990 and 2008, the number of businesses shrank by 40%. The remaining farms take over the production and increase in scale. This process is largely brought on by the high cost of labour. In 2008, 75 000 businesses were active in the sector: 25% with dairy cattle; 25% with “other grazers”, such as beef cattle, sheep and goats; and 6 500 intensive livestock operations raising pigs or poultry. (The Dutch agricluster in a global context 2010.)

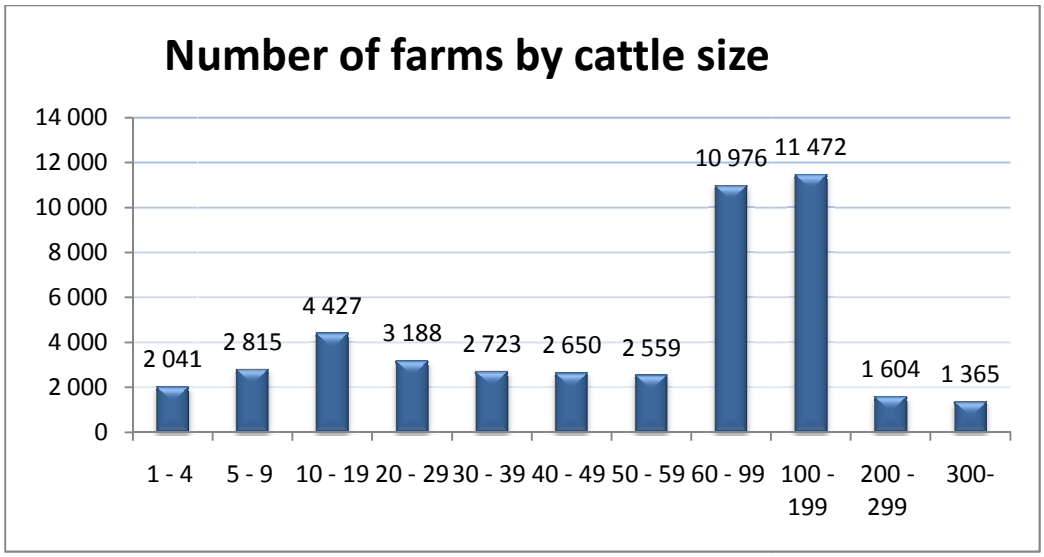

FIGURE 14. Netherlands: Number of farms by cattle size 2000 (Statline 2010).

The Figure 14 demonstrates the cattle farm structure of the Netherlands. In 2000, there were over 45 000 cattle farms, of which a majority was farms with 60 to 199 cows. Of the studied European countries, the Netherlands has the second largest number of cattle farms. However, the data are relatively old, thus questionable to certain extent.

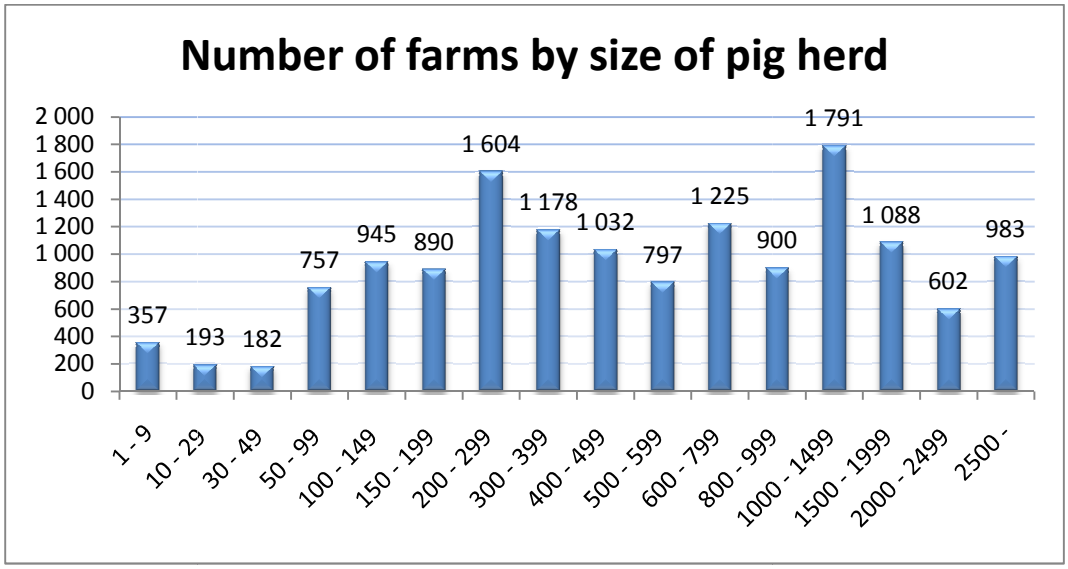

FIGURE 15. Netherlands: Number of Farms by size of pig herd 2000 (Statline 2010).

Like with the cattle farms, the Netherlands also has the second largest number of pig farms of the studied European countries. As the Figure 15 shows, all of the

size classes are quite well represented and only the three smallest size classes have fewer than 500 farms. Most farms have 200-1 999 pigs.

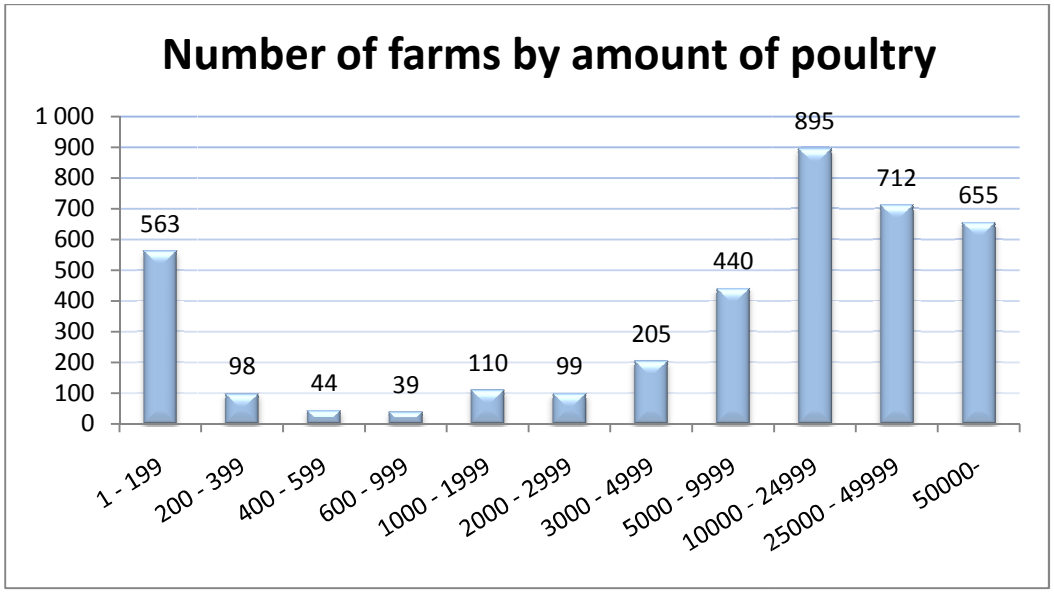

FIGURE 16. Netherlands: Number of farms by number of poultry 2000 (Statline 2010).

At least ten years ago there were about 3 800 Dutch poultry farms. The most represented size classes are those having more than 10 000 chicken. The other studied European countries have smaller farms, whereas the Dutch farms are bigger in size.

3.1.5 Russian Federation

Besides being the largest country in the world, Russia also has one of the fastest growing economies, thanks to high world energy prices and Russia's status as the world's largest energy exporter. Approximately 9 % of the world's cultivation area is in Russian territory. However, there is 221 million hectares of arable land, of which only 35 % was in use in 2007. In 2008, the total value of agricultural production was 44 billion roubles, of which large agricultural organisations produced over 42 per cent. (Venäjä maaraportti 2010.)

In 2006, there were approximately 12 million cattle, pig and poultry farms in Russia. The All-Russian Agriculture Census (ARAC) has divided the farms into three types: agricultural organisations; peasant farms and individual entrepreneurs; and private farms. The private farms count for 99 % per cent of all farms. All together there were 29 000 agricultural organisations and 74 000 peasant or entrepreneur farms. (ARAC 2008.)

Private farms are excluded from further study in this thesis, as ARAC has defined those to be farms that only produce agricultural products to meet their own needs. To make the examination of the Russian farms clearer, the peasant and entrepreneur farms were also excluded, as the ARAC definition on those was too ambiguous. Thus, the examination is based on Russian agricultural organisations.

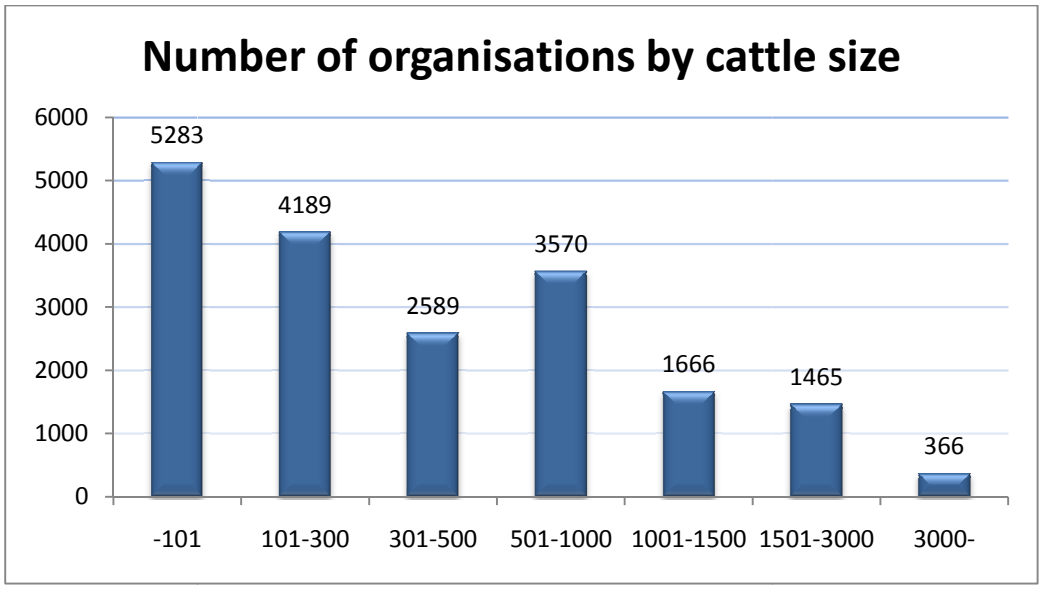

FIGURE 17. Russia: Number of organisations by cattle size 2006 (ARAC 2008).

In 2006, there were almost 20 000 agricultural organisations with cattle in Russia. Figure 17 demonstrates the structure of these organisations. Even though the biggest single size class is the class under 101 cows, the distribution is quite even, at least with the four first classes.

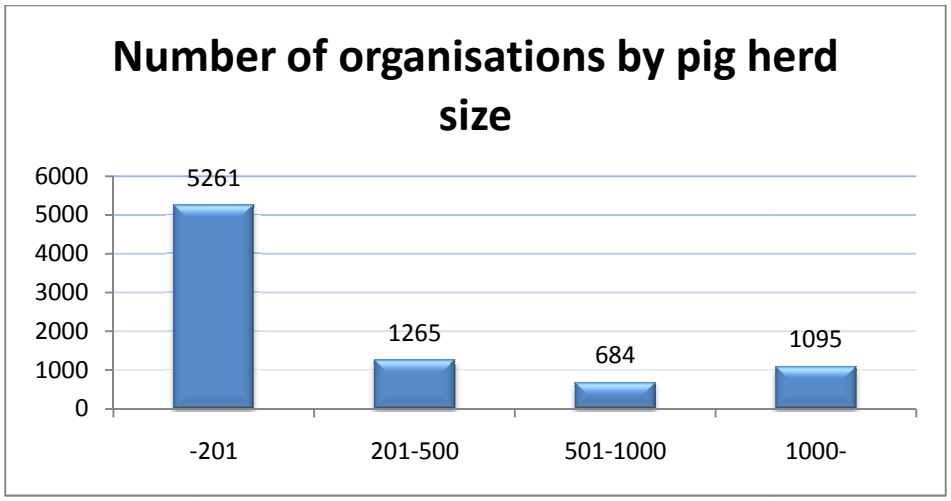

FIGURE 18. Russia: Number of organisations by pig herd size 2006 (ARAC 2008).

As can be seen from the Figure 18, organisations with pigs are mostly those with fewer than 201 animals. Totally, there were about 8 000 pig organisations in 2006. About 40% of the farms have herds bigger than 201 animals.

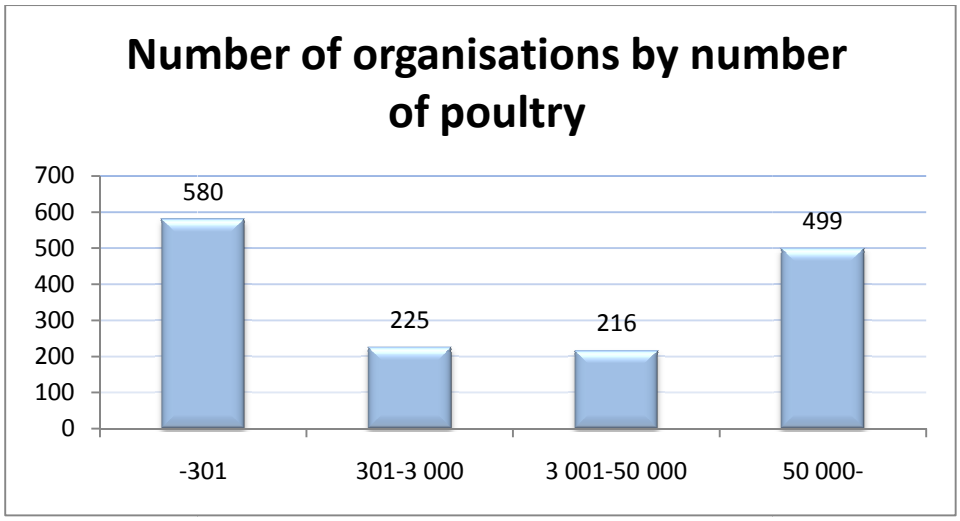

FIGURE 19. Russia: Number of organisations by number of poultry 2006 (ARAC 2008).

In 2006, there were approximately 1 500 poultry farms in Russia. Figure 19 shows that one third of the farms have less than 301 chickens, one third over fifty thousand chickens and the rest of the farms are in between. The number of poultry organisations is about the same as in Finland.

3.1.6 Ukraine

During the Soviet times, Ukraine was called the granary of the Soviet Union, as it was producing most of the grain for the whole state. Nowadays agriculture counts for about 10 per cent of the gross domestic product. There is 42 million hectares of arable land and 80 % of it is being cultivated. The amount of livestock has substantially decreased after the independence in 1991. During the past few years, especially small farms have had to give up farming due to the increasing price of feed. To turn the development positive, the Ukrainian government has approved a national programme lasting to 2015 to promote livestock operations. By 2015, the amount of cattle is to be raised to 11.4 million (5.2 million in 2009), the number of pigs to 13.5 million (6.5 million in 2009) and the number of poultry to 198 million (176 million). (Ukraina maaraportti 2010.)

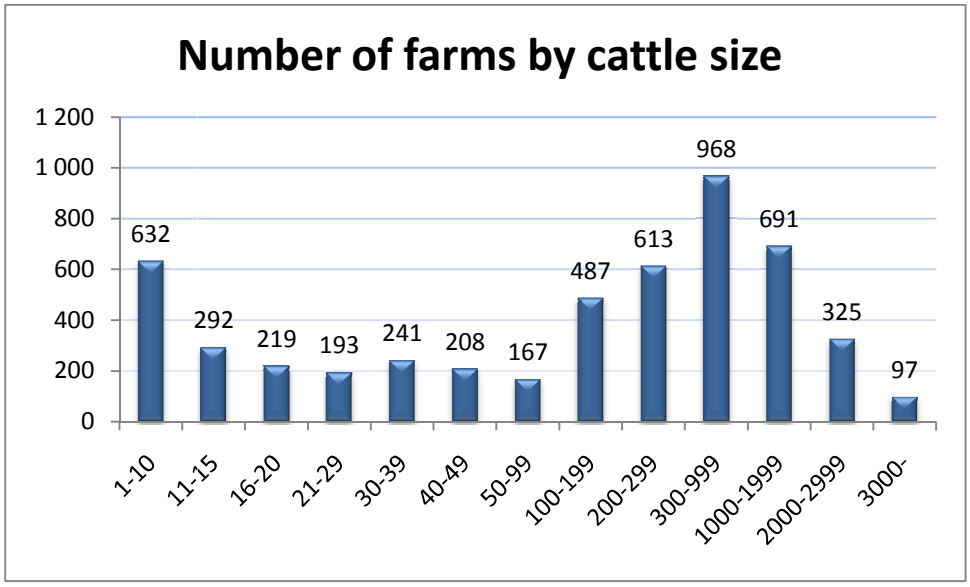

FIGURE 20. Ukraine: Number of farms by cattle size 2009 (GAIN 2009).

Figure 20 presents the 2009 cattle farm structure in Ukraine. Most of the farms have more than 100 cows, even though farms with over 3 000 cows are the most scarce. The total number of these farms is a bit over five thousand.

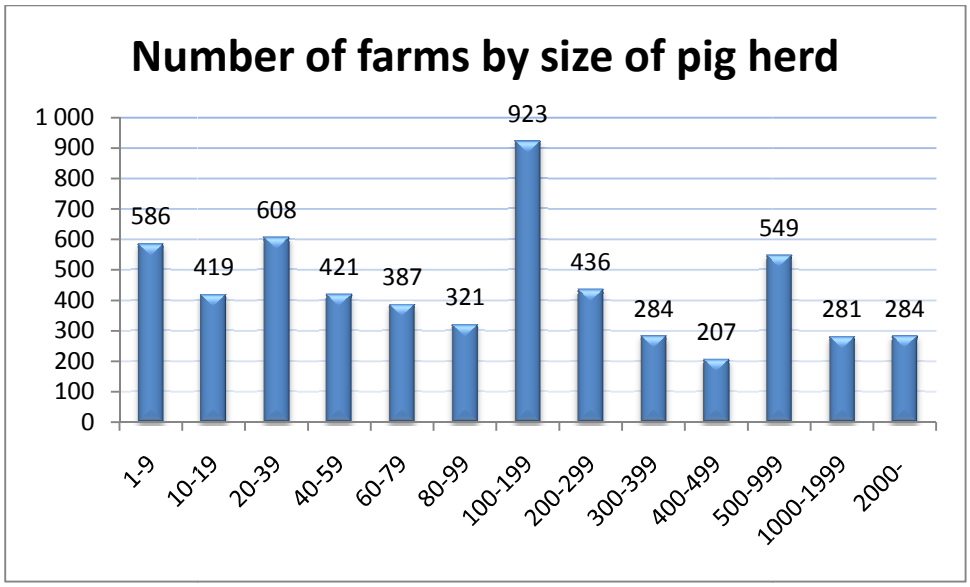

FIGURE 21. Ukraine: Number of farms by size of pig herd 2009 (GAIN 2009).

There were 5 700 pig farms in Ukraine in 2009. As can be seen from Figure 21, all of the thirteen different size classes have more or less the same number of farms. The only exception is the centremost class, which is clearly the biggest.

Data about Ukrainian poultry farms is not presented, as the Ukraine state statistics office does not gather farm structure data and the Global Agricultural Information Network (GAIN) has only investigated the cattle and pig farms.

3.1.7 United States of America

The United States is the world's largest beef producer and second-largest pork producer. Milk has a farm value of production second only to beef among livestock industries. Usually family-owned and managed, dairy farms are generally members of producer cooperatives. Poultry and egg production is expected to expand in the coming years to meet higher domestic and foreign demand. There are approximately two million farms in the United States. Relatively small amount of large farms generates the majority of farm sales. Only 20% of the farms have a turnover over 100 000 US dollars. However, these farms control 60 per cent of all cultivated land. (USDA 2010.)

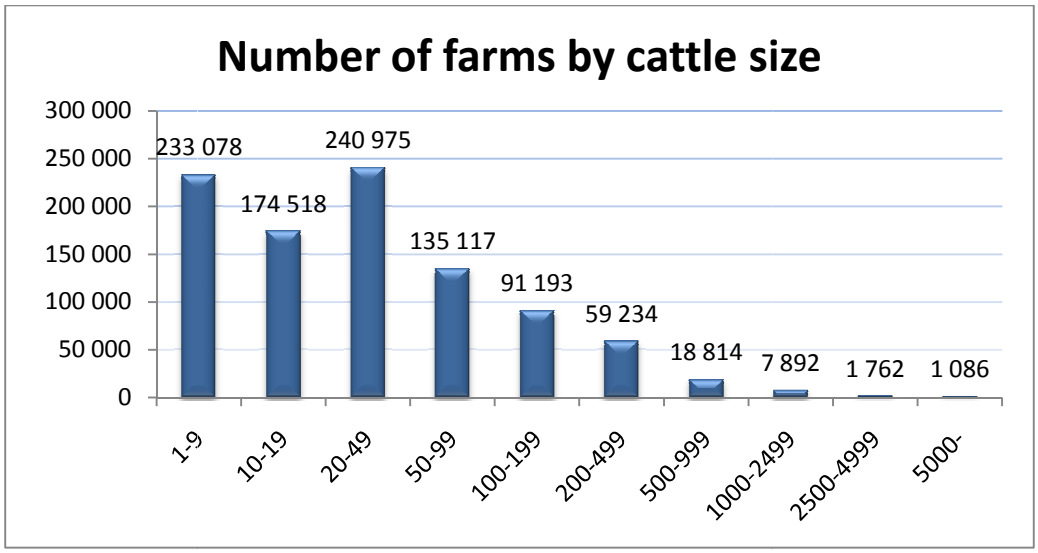

FIGURE 22. USA: Number of farms by cattle size 2007 (Census of Agriculture 2010).

The USA clearly has the greatest market potential in terms of number of farms. Solely the number of cattle farms is close to one million. Seventy per cent of the farms have herds smaller than 50 animals. One has to keep in mind that even though Figure 22 gives the impression that there is only a small amount of large farms, the amount of farms in the three largest categories is equal to the total amount of farms in Finland.

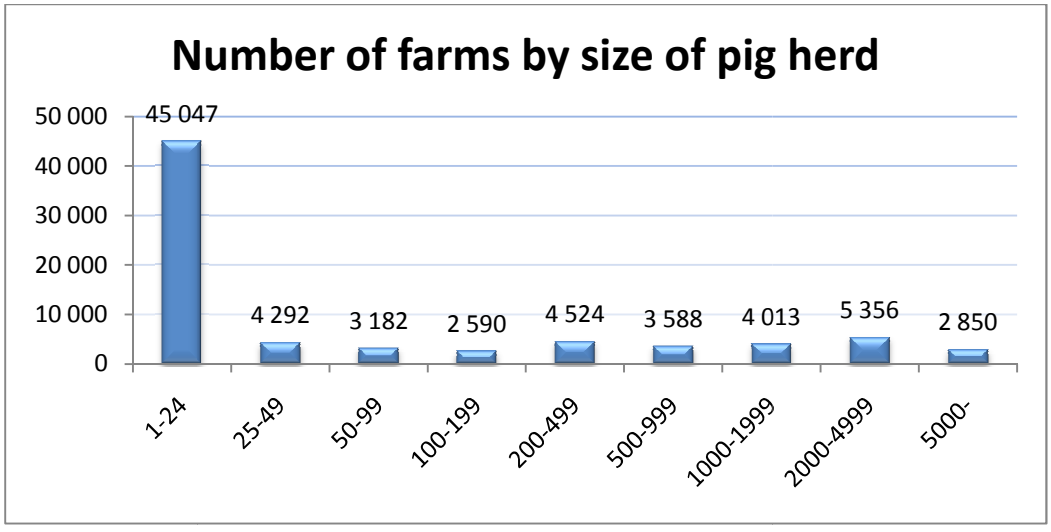

FIGURE 23. USA: Number of farms by size of pig herd 2007 (Census of Agriculture 2010).

The total number of pig farms in USA is about 75 000 farms. As can be seen from Figure 23, over a half of the farms belong to the smallest size class. To give some perspective, it could be noted that the total number of Finnish pig farms is smaller than the amount of U.S. farms with 100-199 pigs.

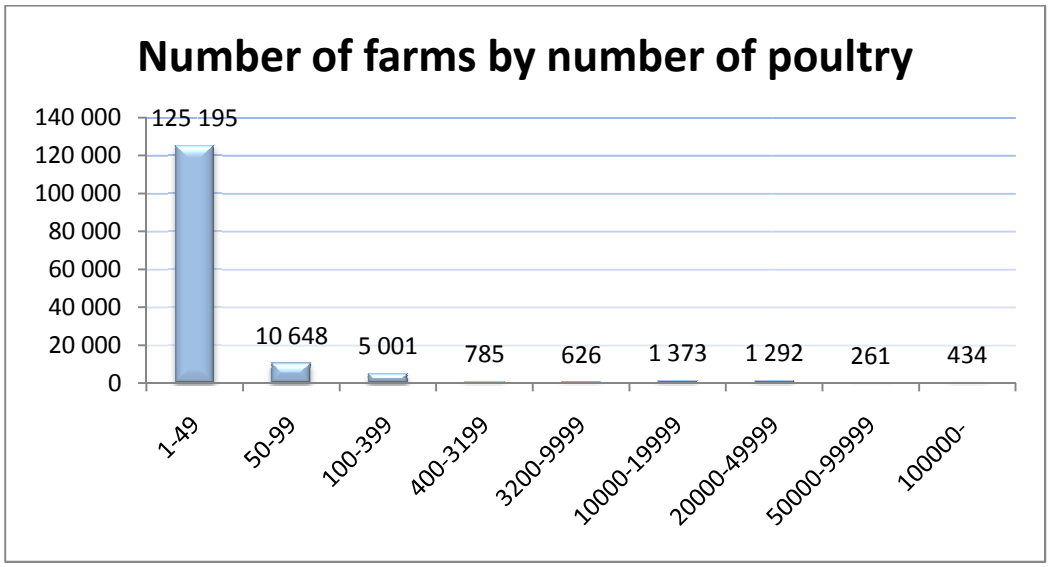

FIGURE 24. USA: Number of farms by number of poultry 2007 (Census of Agriculture 2010).

The amount of poultry farms in all of the studied European countries equals to 10% of the U.S. market. There are over 145 000 farms raising chicken in the USA. Though the Figure 24 again might give the impression that there is huge amount of small farms and no large-scale organizations, one has to keep in mind that the data points are very different to those in the European figures.

3.2 Farm Structure Analysis and Market Selection

All of the countries presented in previous chapters show signs that they might be good choices for target markets. In this chapter, the markets are analysed against each other, the theoretical background as well as three markets for further study are selected and the selections justified.

After the statistical data had been gathered, a theme interview with the commissioner was held. In this meeting, the findings and possible solutions to the market elimination were discussed. The key attributes to the target market selection, besides the actual market size, are the distance factors and market intuition, which both were discussed in the theoretical framework. In addition, a generally acknowledged rule of thumb in internationalisation is that a company needs to be first strong in domestic market, before entering new ones.

Based on the previous, Finland is selected as one of the countries to be studied in more detail. Even though the market size could be bigger to be more attractive, the domestic markets should definitely be looked into. As the company will be founded in the near future, they have limited existing knowledge and experiences about the Finnish biogas markets.

The second country is Germany. First major factor is the size of the market. Germany is without a doubt Europe's largest target market in terms of farm amount. The second factor is market intuition. Germany is known to be technologically driven and on the European scale, a giant in the biogas business. Third factor is cultural and geographic distance. Germany is, in both ways, very close to Finland. This will, most definitely make the market entry process easier. In addition, the fact the both Finland and Germany are members of the European Union, is a great plus.

The third country selected to the second phase of the research is Denmark. This might seem like an odd choice, because it is not among the biggest of the studied markets. The selection of Denmark for further study is based on market intuition, distance factors and the situation of the company. Because the company has not been founded yet, their financial resources are obviously limited. This leads to the fact that markets closer to the company's home country demand less investment and feel safer for a start-up. The fact that Denmark is also a member of the EU is a plus, like with Germany.

Some might question why Denmark was selected instead of the Netherlands or the USA, for example. First, the Netherlands is indeed a prospective target market.

The reason why it is not selected for further study is that the market data are so out-dated and newer information could not be found. Thus, the Netherlands should definitely be researched in more detail, just not in this thesis. The reason for rejecting the USA is distance and market intuition. Like the Netherlands, the USA is a prospective target market. However, selections had to be made, and due to the geographical distance, USA was eliminated from this research.

The elimination of Ukraine is based on the market size. Of the studied countries, it is without a doubt the smallest. Russia is, like the Netherlands and USA, a prospective market. However, in this case it is rejected due to the market intuition of the commissioner. According to their knowledge, Russia just might not be the best country to start.

As mentioned in the beginning of this chapter, all of the countries have potential markets and their positive sides, but some of the countries had to be eliminated from further research. The three selected countries: Finland, Germany and Denmark, and their biogas policies are presented in the following chapter.

4 CHOOSING TARGET MARKETS: BIOGAS POLICIES

In the second phase of the target market selection, three countries are studied in more detail. The selected markets are Finland, Denmark and Germany, as discussed in Chapter 3.2. In this part of the thesis, the biogas policies are studied and evaluated. The main issues that affect the market attractiveness are different support policies. In the following paragraphs, these main instruments for RE support are defined.

Biogas support schemes can be tariff schemes or different subsidies. These systems play a major role in the energy markets. Generally, the subsidies are granted for companies, municipalities or other organisations for climate and environment friendly investment- and research projects.

Feed-in Tariffs (FiT) and Premiums are used by governments to encourage investment in new, cleaner renewable energy sources. FiT is a premium rate paid for clean generation of energy and guaranteed for a long period. The energy producer is guaranteed a certain rate; if the market price is lower than this rate, the government or consumer pays the difference. (KTM 2007, 38).

The regulatory framework is briefly gone through on a European level, as it describes the operational environment for biogas producers. The European legislation sets the guidelines for all agricultural and energy companies operating in the member countries.

Though all of these aspects have more impact on the clients than the case company per se, it has to be recognised that markets that support the consumers have more potential. If there are no instruments to support the customers' investments, companies producing innovative RE solutions may find it difficult to get their products sold.

4.1 EU policies

As all of the selected markets are member states of the European Union, they have certain common policies that set the framework for operating a biogas plant. This chapter presents the two main regulatory aspects. The first is the Animal By-product Regulation; the second is the IPPC Directive, which imposes obligations related to Best Available Techniques and Environmental Permits. These aspects are briefly gone through to give a general idea of the main regulative aspects regarding biogas operations.

4.1.1 The Animal By-products Regulation

The European Parliament and the Council regulation laying down health rules concerning animal by-products not intended for human consumption (1774/2002/EC) has a major impact on the operation of biogas plants that processes animal by-products. The regulation provides for permitted treatment methods of by-products as well as microbiological quality, usage limitations and disposal methods of end products. The current regulation is valid until 4 March 2011, when it will be replaced by a new regulation: 1069/2009/EC. The aim of the revised regulation is to clarify, for example, the processing requirements of the feed.

The animal by-product regulation divides the by-products into three risk-categories, which have different processing requirements. Category 1 by-products contain the most hazardous health risks; these products may hold the risk of Transmissible Spongiform Encephalopathy (TSE) diseases. Manure is classified to category 2 animal by-products. Before using category 2 products in biogas installations, they need to be for example sterilised (20 minutes in 3-bar pressure at 133°C). Manure can be used as raw material for biogas plants without hygienisation when the end product after processing is considered as unprocessed manure or when the manure is processed in a biogas facility nationally approved according to the Act on Fertilizer Products. Category 3 by-products are fit for human consumption, but are not intended for groceries or their raw material. (Latvala 2009, 16-17.)

The Animal By-products Regulation provides that biogas plants are subject to approval by the competent authority (15§). The regulation also states that the operators and owners of processing plants shall put in place, implement and maintain a permanent procedure developed in accordance with the principles of the system of hazard analysis and critical control points, HACCP (25§).

4.1.2 Integrated Pollution Prevention and Control: IPPC Directive

The IPPC Directive (4§) requires industrial and agricultural activities with a high pollution potential to have a permit. The permit can only be issued if certain environmental conditions are met, so that the companies themselves bear responsibility for preventing and reducing any pollution they may cause. The permits are to be applied from regional environment institutes.

The IPPC concerns new or existing industrial and agricultural activities with a high pollution potential, like energy industries, waste management, livestock farming and so on. The directive imposes mandatory environmental conditions, which the industrial or agricultural installation must comply with to receive a permit to operate. In particular, it must:

- use the Best Available Techniques (10§);
- prevent all large-scale pollution (9§);
- prevent, recycle or dispose of waste in the least polluting way (9§);
- use energy efficiently (9§);
- ensure accident prevention and damage limitation (9§);
- return sites to their original state when the activity is over (9§).

The Best Available Techniques (BAT) refers to methods of production and treatment that are as efficient and advanced as possible and technologically and economically feasible, and to methods of designing, constructing, maintenance and operation with which the pollution caused by activities can be prevented or most efficiently reduced. (Latvala 2009, 15.)

4.2 Finnish Biogas Policies

Finland is one of the world's leading countries in the utilisation of RES, especially bio energy. A quarter of Finland's total energy consumption and more than one fourth of its power generation is covered with renewable sources of energy. The country's most important renewable sources of energy are bio energy, wood and wood-based fuels in particular, hydropower, wind power, ground heat and solar energy. (Uusiutuvat energialähteet 2010.)

The objective of the Finnish national energy and climate strategy is to increase the use of RES and their share in energy consumption. In 2009, the share of RES in Finnish energy consumption was 26 per cent. By 2020, the portion should be increased to 38 % according to the directive on renewable energy (2009/28/EC). The aim of the Finnish national energy strategy is to stop the increase in energy consumption and to turn the trend into a decline. In addition to energy conservation, this is one of the most significant means in achieving Finland's climate targets. The use of renewable energy sources does not increase carbon dioxide emissions. In addition, the use of these sources would promote employment and regional policy goals and enhance the security of supply of electricity. The strategy also supports technology exports of the industry, which is already becoming an important part of the Finnish exports. (Uusiutuvat energialähteet 2010; Bioenergia maa- ja metsätaloudessa 2008, 32.)

The main support instruments for renewable energy are investment subsidies and a tax measure. Subsidies are available for investment and research projects. The different branches of government have their own support schemes and the supported subjects vary. A feed-in tariff system is being developed at the time of writing this thesis. The following chapters present the Finnish national renewable energy policies.

4.2.1 Energy Support Scheme of the Ministry of Employment and the Economy

The investments and research ventures by companies, municipalities and communities that relate to biogas production can seek for funding from the MEE's Energy Support Scheme nationally and from the European Regional Development Fund regionally. The support cannot be granted for agricultural investments. (TEM 2009, 25).

The energy support scheme is aimed to promote the use of RES, energy efficiency, energy production efficiency and ventures that decrease the environmental damages of energy production and usage. Priority is given to ventures that support the commercialisation of new technologies. The maximum level of support depends on the subject and the newness of the used technology, usually varying in between of 25 and 40 per cent. (TEM 2009, 25).

TABLE 1. MEE support for biogas ventures (TEM 2009).

	2004	2005	2006	2007	2008
Ventures	1	3	1	2	4
Granted support (€)	1 951 000	1 409 500	113 750	134 595	5 817 560

Table 1 presents the amount of granted support between the years 2004 and 2008. During these years, the average support level of investments that promote the production and use of biogas has been approximately 25-30% of the total expenses. Only the expenses that relate to energy production are supported. As the biogas ventures are usually based on conventional technology, the amount of granted energy support has been rather small. (TEM 2009, 25).

4.2.2 Electricity Production Support

The electricity produced with RES is supported with Electricity Production Support (1260/1996). Earlier the support was equal to the tax on electricity paid by consumers, and the support could be seen as tax refund. Nowadays the support is lower than the tax paid by the consumers. The European Commission has

approved Finland's current tax support for electricity production until the end of 2011. The support is granted to electricity produced with wind energy (6.9€/MWh), solid recovered fuels (2.5€/MWh), biogas and hydropower (4.2€/MWh). (TEM 2009, 25.)

TABLE 2. Support for electricity produced with biogas 2004-2008 (TEM 2009).

	2004	2005	2006	2007	2008
Support for electricity produced with biogas (€)	40600	47700	65400	66000	56800

As can be seen from Table 2, the amount of paid support has been increasing over the years, except for the year 2008. During that year, the amount of paid support was decreased by 14 % in comparison to the previous year. The total yearly amount of the support is not very significant.

4.2.3 Agricultural Subsidies for Promoting Bioenergy Production and Use

Rural Investment Funding is meant for agricultural biogas installations and agricultural heat stations using RES. The amount of funding for a heat station varies according the target. The funded biogas installations need to get at least half of the used raw material from the owning farm and at least half of the produced energy need to be used in the farm. (TEM 2009, 26).

The Rural Development Programme for Mainland Finland aims at supporting bioenergy investments in rural micro-companies. The funding can be granted for processing bioenergy products, producing bio-based energy or for other bioenergy business related construction investments. The maximum funding varies between 10-35 per cent of acceptable total costs depending on the location and type of company. (TEM 2009, 26.)

Bioenergy Production Support is a discretionary grant. Appropriation of the clause is 5 million Euros annually (2008-2011) and it can be used for research, survey, training and awareness-raising projects preceding the founding of a biogas

plant and pilot projects applying new research and technology. The appropriation is also used to fund coordination and information projects of the bioenergy industry and to implement Farm Energy Programme that promotes energy saving measures. Bioenergy Production Support investment funding is meant to promote the use of biomass in energy production. Of special interest is the construction of biogas plants to areas with lots of farm animals and environmental effects related to those. The combined share of public funding cannot exceed 45 per cent of the venture's acceptable costs. The share of funding can however, be raised to 55 per cent with medium-sized enterprises and to 65 per cent with small enterprises. (TEM 2009, 26).

4.2.4 Grid Connection

The Electricity Market Act (386/1995) provides guaranteed access to the grid for all electricity users and electricity-producing plants, including RES generators.

According to the Act, the grid operator should expand his grid according to customer needs. The grid operator bears the cost of an expansion, if it is done to satisfy the needs of more than one grid user. The grid operator also bears the cost if the capacity of the installation to be connected does not exceed 2 MW. The installation operator pays to the grid operator a reasonable compensation for the connection of his system to the grid. The grid operator is obliged to provide a detailed list of the grid connection costs upon request. (Renewable Energy Policy 2009, 80.)

The installation operator has a balance responsibility. The operator is responsible for ensuring that the electricity generation and electricity acquisition contracts cover the operator's electricity use and supply during each hour. This is based on the fact that the national electricity system needs to be reliable and efficient at all times. (Renewable Energy Policy 2009, 81.)

4.2.5 Government Bill on Biogas Feed-in Tariff

In Finland, feed-in tariffs are in use only for wind power at the moment. However, the Finnish Government has made a bill (HE 152/2010) to the Parliament on

production support for electricity produced with renewable sources of energy. The proposed law would promote electricity produced with wind power, biogas and wood fuels. The bill is supposed come into effect on January 1st 2011. (HE 152/2010.) At the time of writing this thesis, the bill is at the stage of Committee handling in the Committees of Finance, Constitutional Law, Environment and Agriculture and Forestry. The following paragraphs describe the main idea of the bill with regard of biogas.

The principal of the Finnish feed-in tariff is a market-based guarantee price, which includes features of both a guaranteed price and a premium. This way the market orientation is preserved and the producer is guaranteed a steady income level. In the scheme, the producers sell the produced electricity to the market and they are paid a tariff determined by the difference between agreed target price and electricity stock price (3-month spot price). The scheme encourages on production during more expensive hours than average. (Briefing on the bill HE 152/2010.)

Not all renewable energy producers or biogas plants are accepted to the tariff scheme. First, there are general prerequisites for a biogas plant to be approved to the tariff system: the plant is located in Finland or Finnish territorial waters and is locally connected to power grid. The plant also needs to have functional and financial qualification for energy production. Secondly, the production method based prerequisites determine that a biogas plant can be accepted to the tariff system only if:

- it has not received any government support;
- it is new and does not include used parts;
- its generators combined rated power is at least 100 kVA; and
- it uses such biogas as fuel, which has been produced in a facility that has not received any government support, is new and does not include used parts. (HE 152/2010.)

The aforementioned biogas plant can be entitled to feed-in tariff raised with heat (Combined Heat and Power) premium if:

- it produces utilisable heat with electricity production; and

- its total efficiency is at least 50%, or if the generators' combined rated power is > 1 MVA, at least 75%. (HE 152/2010.)

According to the bill (HE 152/2010), the tariff is paid for 12 years and equals the difference between target price and three-month stock price. The target price has been set to be 83.5€ / MWh. A biogas plant is, in addition, paid a CHP premium of 50€/MWh, if the aforementioned conditions of the premium are met.

4.3 German Biogas Policies

Biomass is one of the most important and diverse renewable energy sources in Germany. Biomass accounted for approximately 69 percent of total final energy from renewable sources in 2007. Bioenergy accounted for 3.9 percent of total electricity consumption, 6.2 percent of total heat demand and 7.6 percent of total fuel consumption. By 2020, the German government aims to increase the share of renewable energies to 18% of total final energy consumption, at least to 30% of total electricity consumption, to 14% of heat supply and to 12% of total fuel consumption. (BMU Renewable Energy 2010.)

Energy from biomass has become an important economic branch in Germany. Some 96,100 people were employed in the bioenergy sector in 2007, particularly in agriculture and forestry raw material production and the newly set up industry of producing fuels such as pellets, wood chips or biogas from biomass. The total turnover for the entire bioenergy sector amounted to 10.23 billion euro in 2007. By the end of year 2008, there were approximately 4000 biogas installations and their combined production capacity was about 1400 MW. (BMU Renewable Energy 2010.)

The main support instrument for electricity produced with RES is a feed-in tariff scheme. All relevant technologies are eligible, except for co-firing in conventional power plants. The scheme grants fixed feed-in tariffs for a period of 20 years. Tariffs are differentiated by technology and size of installation, and are subject to

annual degression for new installations. Additional bonuses are paid for the compliance with further quality criteria. There is no cap on the support, as the scheme is not financed by governmental budget, but by the final consumer. (BMU Renewable Energy 2010.)

Under the feed-in scheme, support is paid for both the electricity and the green value together. The operators have to register their installation with the federal grid regulator in order to receive the support. The Renewable Energy Sources Act does not include an obligation to use certified equipment or certified installers. Tariffs are differentiated by source, technology and installed capacity. (BMU Renewable Energy 2010; TEM 2009, 31.) In addition to the feed-in tariff system, there are further fiscal measures to support renewable energy installations. Low interest loans for different technologies are available from state-owned KfW Bankengruppe. One project can profit from both feed-in tariff scheme and low interest loans.

4.3.1 Feed-in Tariffs

The German feed-in tariff scheme was introduced as early as 1990. After that, the system has been modified several times. The latest law is Renewable Energy Sources Act (Erneuerbare-Energien-Gesetz - EEG), which enacted on January 1st, 2009. The act and the tariffs are reviewed regularly by the Federal Ministry of Environment (BMU); the Federal Ministry of Food, Agriculture and Consumer Protection; and the Federal Ministry of Economics and Technology. The next evaluation report is scheduled for 31st December 2011. (TEM 2009, 31.)

The German scheme obligates the local grid system operators, as a priority, to purchase, transmit and distribute the entire available quantity of electricity from renewable energy sources and pay installation operators tariffs for electricity generated in installations exclusively utilizing renewable energy sources (EEG 2009, §§ 8(1) and 16). The transmission system operators are further obliged to purchase the electricity from the local grid system operator (EEG 2009, 8(4) §). The costs of the scheme are levelled regionally and on a yearly basis (EEG 2009, 36(2) §). Principally, the FiT is guaranteed for 20 years and the amount of FiT

depends on the inauguration year of the biogas plant (EEG 2009, §§ 21(2) and 20).

The German biogas tariff scheme provides that the producer of the renewable energy is paid a basic tariff and various bonuses in addition. The following Table 3 presents the minimum feed-in tariffs and degression rates for electricity produced from RES for the period 2009 to 2018. All the bio- and landfill gas tariffs are paid for 20 years. Once granted, the amount of paid tariff does not change, but for new installations, the tariff declines yearly by a pre-set percentage. (TEM 2009, 31; EEG tariffs and sample degression rates 2010, 6-8).

TABLE 3. German Biomass Feed-in Tariffs (EEG tariffs and sample degression rates 2010).

	Production capacity MW	Basic tariff (2009) €/MWh	Bonuses, €/MWh					Degression rate (%/a)**
			CHP	Energy crops	Land-scaping*	Manure > 30%	Techno-logy	
Landfill gas	0-0.5	90	-	-	-	-	20	1.5
	0.5-5	61.6	-	-	-	-	20	1.5
Sewage gas	0-0.5	71.1	-	-	-	-	20	1.5
	0.5-5	61.6	-	-	-	-	20	1.5
Other biogas	0-0.15	116.7	30	70	20	40	20	1
	0.15-0.5	91.8	30	70	20	10	20	1
	0.5-5	82.5	30	40	-	-	20	1
	5-20***	77.9	30	-	-	-	-	1

* Using mostly residues from landscape activities

** The rate by which the tariff and bonuses yearly degrade for new installations

*** Tariffs are paid for installations over 5MW only if they are CHP-installations

The amount of paid tariff has been specified according to the type of installation and the production capacity. However, installations in the bigger size classes get higher tariffs for the power shares that are under the lower tariff limit.

In this scheme, the basic tariff for installation with production capacity of 500 kW is calculated as follows:

> Share under 150 kW (30% of total capacity) 0.3*116.7€/MWh +
> Share under 500 kW (70% of total capacity) 0.7*91.8€/MWh =
> 99.27€/MWh.

Different additional bonuses are granted for certain characteristics, such as innovative technology, the fulfilment of sustainability criteria or high efficiency. The bonuses are calculated using the same principles. The smaller installations are paid bigger tariffs and that has led to the building of multiple biogas plants for the same raw-material sources. (EEG tariffs and sample degression rates 2010.) The total support level for a biogas plant installed during 2010 varies between 77.1 and 293.7 Euros per Megawatt hour. In this calculation, the degression rate of one per cent has been taken into consideration.

The EEG encourages the use of Combined Heat and Power in biomass installations. Installations producing “other biogas” are paid CHP-bonus for the share of electricity that counts as CHP-electricity. The bonus is 30 Euros per MWh up to an installation capacity of 20 MW. Installations with an installed capacity of over 5MW are obliged to use CHP technology. A prerequisite for the CHP-bonus is utilisation of the heat in separately listed destinations. A certificate of CHP-production, granted by environmental inspector, is to be presented yearly. CHP-installations with production capacity under two MW only need to present documentation from the plant manufacturer. (TEM 2009, 32.)

4.3.2 Grid Connection

There is a shallow connection charge philosophy in Germany. As mentioned, according to the EEG, grid operators are obliged to feed in renewable energy, with priority over conventional generators. It is granted further priority in dispatch and transmission system operators are obliged to purchase the electricity from the

local grid system operators. The connection charges are calculated on an individual basis. Generally, they are rather low, due to the "shallow" charging approach. Extension measures in the grid which are necessary for the connection and reception of RE are paid by the grid operator. The plant operator bears the costs of grid connection to the economically next-best connection point. This includes the costs for the necessary measuring devices. (Renewable Energy Policy 2009, 104.)

4.3.3 Market Incentive Programme for Renewable Energies on the Heat Market (MAP)

The MAP is a financial incentive programme that provides investment subsidies and grants to heat producing bioenergy plants. It also offers long-term, low-interest loans with a fixed interest rate and redemption-free years for installations producing heat from RES. The supervising authorities of the MAP are the Federal Ministries of Environment and of Finance and the programme is financed from federal funds. The years 2009 to 2012 were reserved a budget of 500 million Euros per year. (Renewable Energy Policy 2009, 100.) The MAP is divided into two parts: Investment Grants & Subsidies and KfW Bankengruppe's Renewable Energies Programme.

Investment grants and subsidies for new installations or the extension of existing installations are provided through the Federal Office of Economics and Export Control (BAFA). Among the eligible technologies are:

- automatically fed plants for the incineration of solid biomass for heat supply up to 100 kW heat power;
- manually fed plants for the incineration of solid biomass for heat supply between 15 and 50 kW heat power; and
- secondary measures for the reduction of emissions and for the increase of efficiency in plants for the incineration of solid biomass up to 100 kW heat power. (Renewable Energy Policy 2009, 101.)

Support is granted to private individuals, self-employed professionals, SMEs, municipalities and NGOs. Large-scale enterprises only benefit from the support in specific cases (deep geothermal energy, large-scale solar thermal energy, heat distribution networks). Biogas installations are to be certified by TÜV (The German Technical Inspection Association) or a public research institute. Applications for support are reviewed by BAFA. Financial support is differentiated for different sources and technologies. It consists of a base support and additional bonus for efficiency, combination of technologies and the exchange of boilers, for example. The base support level for new installations (building application after 1.1. 2009) is 25% lower than support for existing buildings. (Renewable Energy Policy 2009, 101.)

The KfW Renewable Energies Programme offers long-term, low-interest loans with fixed interest rates, as well as an additional redemption-free year at the end of the loan duration, as a bonus. All the qualified net investment costs are can be supported, up to a maximum loan amount of usually five million Euros. Eligible technologies are:

- biomass-installations with an installed capacity >100 kW
- installations for the conditioning of biogas to natural gas quality
- biogas-lines for untreated biogas
- local heat grids for RES based heat, as well as large heat storage installations for heat from RES. (Renewable Energy Policy 2009, 101.)

4.4 Danish Biogas Policies

The contribution of renewable energy sources to the overall electricity consumption in Denmark was 28.3% in 2007. The Danish government has a goal that in 2025, half of the Danish electricity consumption is covered by RES. In Denmark, biomass makes up about 70% of renewable energy consumption. The majority of biomass is straw, wood and biodegradable waste whereas biogas contributes to a lesser extent. (Danish Energy Agency 2010.)

With 20 centralised plants and over 35 farm-scale plants, the digestion of manure and organic waste is a well-established technological practice in Denmark. Apart from three municipally owned joint biogas plants, all plants are owned exclusively or jointly by the farmers involved. Biomass consumption has quadrupled in the period from 1980 to 2005, and further increases are expected in future - primarily in heat supply, small-scale installations and as large-scale power plants. (Climate & Energy Guide 2010)

The Danish FiT was formally implemented in 1993, and phased out in 2002. The current incentive is based upon a quota style market price plus premium system. The support level for electricity produced from biomass, biogas and wind turbines was increased in 2008. (Danish Energy Agency 2010.) Energinet.dk, the transmission system operator, administers society's subsidies for production, research and development in renewable energy. Public service obligations (PSO) are an item on the consumers' electricity bills. PSO is the tariff Energinet.dk charges on behalf of the society to finance subsidies for renewable energy production and development. (Energinet.dk 2010.)

The PSO funds that Energinet.dk is responsible for on behalf of society are used for a number of purposes to the benefit of society:

- Subsidies for renewable energy production
- Connection of RE production to the electricity grid
- Security of supply
- Research and development in RE production. (Energinet.dk 2010.)

4.4.1 Feed-in Premium

In Denmark, the renewable energy production is supported through price premiums and the instruments are prepared and managed by the Danish Energy Agency. Energinet.dk supervises all the important procedural steps related to the promotion of RE. Furthermore, renewable energy is subject to the general statutory provisions related to the supervision of the electricity market. The electricity market is supervised by an independent commission (Energitilsynet - Danish Energy Regulatory Authority), which was established by the Ministry of Environment and Energy. (Renewable Energy Policy 2009, 63.)

Support instruments are regulated by Law on the Promotion of Renewable Energy (1392/2008), the Act on Electricity Supply and the Act on Transmission Grid Operator Energinet.dk. The instruments are revised from time to time, according to the situation in the market. Historically the level of support has changed numerous times, but it is a general rule that the support scheme, which was in place when a production unit was connected to the grid, applies for the lifetime of the production unit. As a result, there is a high level of certainty about future support at the time of investment. (Renewable Energy Policy 2009, 63.)

The Danish renewable energy support instruments were amended in 2008, but the support principles did not change. Denmark promotes electricity from RES through a price regulation. Producers receive a variable premium on top of the market price. The sum of the premium and the market price cannot exceed a certain statutory maximum, which depends on the date of grid connection and the source of energy used. In certain cases, plant operators are granted premiums and are thus not subject to the statutory maximum. The persons entitled to the payment of a premium are owners of systems for the generation of electricity from renewable sources. The heat generation from RES is also supported by tax exemptions. Biomass is exempt from the carbon dioxide tax, as it is CO_2 neutral. (Renewable Energy Policy 2009, 62.)

TABLE 4. Danish Feed-in Tariffs and Premiums (Renewable Energy Policy 2009)

	€/MWh		
	Feed-in tariff	Premium	Duration
Biomass		20.2	10 years
Biogas	100.1		
Biogas mix with other fuels		54.4	

Table 4 presents the Danish feed-in tariffs and premiums. Some projects can be supported by more than one support scheme. For example, in CHP plants, the heat produced using biomass is exempt from energy taxes, and the electricity receives feed-in premium.

Systems commissioned after 2009 are eligible for the following payments:

1. Biogas
   New units producing electricity only from biogas receives a fixed feed-in tariff of 100.1 EUR per MWh. If the biogas is mixed with other fuels, the part of the electricity produced from biogas receives a price premium of 54.4 EUR/MWh. The heat produced using biomass at CHP is exempt from energy taxes.

2. Biomass
   New units producing electricity by burning biomass will receive 20.2 EUR/MWh guaranteed premium. The heat produced using biomass at CHP is exempt from energy taxes. (Renewable Energy Policy 2009, 64.)

The tariff depends on the system installation date. The Law on the Promotion of Renewable Energy specifies several periods and deadlines, which are applied according to the technology used and the date of commissioning of the system in question. The period of payment is usually 10 years, the maximum period being 20 years. Producers cannot choose between a feed-in premium and a fixed feed-in tariff. (Renewable Energy Policy 2009, 64.)

4.4.2 Grid Connection

Priority dispatch is given to renewable electricity (and CHP) over fossil fuel generation when grid capacity is insufficient and the grid is not in danger. Regarding use of the grid, the priority is given for renewable energy. (Renewable Energy Policy 2009, 67.)

According to the Act on Electricity Supply, the grid operator is obliged to expand the grids in order to guarantee an efficient transmission of electricity. The connection policy is shallow with well-established and transparent rules for cost calculation. RES projects only pay the cost that would have incurred when connected to the grid irrespective of whether the grid company selects another connection point. The costs for grid reinforcement are met by the distribution and transmission system operators. In cases where the RES project wishes to connect at a higher voltage level (than 10-20kV), the additional connection costs have to be paid by the project, but the reinforcement costs do not. (Renewable Energy Policy 2009, 67.)

Like in Finland, the installation operator has a balance responsibility. The operator is responsible for ensuring that the electricity generation and electricity acquisition contracts cover the operator's electricity use and supply during each hour. This is based on the fact that the national electricity system needs to be reliable and efficient at all times. (Renewable Energy Policy 2009, 67.)

4.4.3 Energinet.dk Subsidies

As mentioned, Energinet.dk administers the national subsidies for production, research and development in renewable energy. The subsidies are funded by 'Public service obligations' that is the tariff Energinet.dk charges on behalf of society. The PSO is an item on the consumers' electricity bills. Two programmes, of which a biogas installation can benefit from, are introduced in the following chapters. Both of the programmes have yearly focus areas that are prioritised in the application process.

ForskEL is an external research programme supporting the development and use of environmentally friendly technologies for electricity production. According to the Danish Electricity Supply Act, The Danish transmission system operator Energinet.dk, funds R&D in environmentally-friendly electricity generation technologies and reliable transmission systems. The focus areas are approved each year by the Minister for Climate and Energy. The programme has an annual budget of 17.5 million Euros determined by the Danish Parliament. (Energinet.dk 2010.)

There are three prioritised focus areas of the ForskEL 2011: Control and regulation of energy systems; Tomorrow's environmentally friendly electricity generation; and Environmental improvements and greater efficiency. More detailed information each year's focus areas can be found from the Energinet.dk website. (Energinet.dk 2010.)

ForskVE is an external programme supporting the dissemination of small RE technologies, like solar cells, wave power and biogas. The Danish transmission grid operator, Energinet.dk, pays an additional subsidy to small systems for the generation of renewable electricity. Even small pilot projects are eligible. The programme focuses not on research and development but on demonstration and the increased use of renewable energy sources in energy production. ForskVE 2011 focus areas comprise the small RE technologies such as photovoltaics, wave power and biogasification. (Energinet.dk 2010.)

Systems are also eligible if they generate RE, and have been classified as important for the advancement and expansion of RE technologies. According to Energinet.dk, this definition includes new and yet unknown technologies. Energinet.dk has its own budget for the ForskVE programme. This budget is 3.4 million Euros per year and applies to the period of 2008-2011. Energinet.dk decides the amount of subsidy each project is granted. (Energinet.dk 2010.)

Both of these programmes have annual calls for application. The application deadline, which typically lies around the middle of September, is coordinated with the other national energy research programmes. Over the summer, the call for

applications is announced in various newspapers and daily Danish papers, for example Ingeniøren, Børsen and EL&Energi. The call for applications will also be announced at Energinet.dk's website. (Energinet.dk 2010.)

4.5 Biogas Policy Analysis

In this chapter, the biogas policies of Finland, Germany and Denmark are compared and analysed. First, the feed-in tariffs and premiums are compared, then the grid connection terms are gone through and lastly the different subsidy schemes are analysed. The chapter ends with evaluation on target market suitability based on the policies.

Feed-in Tariffs and Premiums

This part compares the paid tariff rates and possible bonuses in the three countries. Though the Finnish tariff scheme is not in use yet, it will be analysed. The basic tariff rates are:

1. Finland: Target price - three-month stock price = Tariff
   83.5€/MWh - 48.59€/MWh = 34.91€/MWh

Nordpool electricity spot prices were used determining the stock price. The biogas producer can also a CHP premium of 50€/MWh and the duration of both the tariff and the premium is 12 years. The maximum level is thus 84.92€/MWh.

2. Germany: Tariff varies between 77.1€/MWh and 115.5€/MWh.

This amount is for plants installed in 2010. In addition, a plant can be paid bonuses from 9.9 to 178.2€/MWh. Duration of payments is 20 years. Thus, for plants installed during 2010 the tariff level is between 77.1 and 293.7€/MWh.

3. Denmark: Tariff is usually 100.1€/MWh and the duration is 10-20 years.

The level of tariff and duration of payment are, however, determined individually from project to project and thus no concrete amount can be told.

Based on the previous demonstrations, the German scheme is undoubtedly the best from a producer's point-of-view.

Grid Connection

Following paragraphs summarises the main points of each country's grid connection policies.

1. Finland: Grid connection is guaranteed, but renewable energy does not have a priority position in dispatching. The grid operator bears the cost of connection, but the installation operator needs to pay a compensation of "reasonable amount".

2. Germany: Grid connection is guaranteed and renewable energy is given a priority in dispatching. Also in Germany, the installation operator needs to pay connection charges that are calculated on an individual basis. Generally, they are rather low, due to the "shallow" charging approach.

3. Denmark: Like in Germany, grid connection is guaranteed and priority dispatch is given to renewable electricity and CHP. The connection policy is shallow with transparent rules for cost calculation. RES projects only pay the cost that would have incurred when connected to the grid irrespective of whether the grid company selects another connection point.

The grid connection policies are rather similar, though in Finland the RE is not given a priority in dispatching. When considering this from the producer's perspective, it actually does not have a substantial effect, as it does not change the payments made to him. Overall, the German and Danish policies seem slightly better than the Finnish policy.

Subsidy Schemes

The three countries have quite different subsidy systems. The following paragraphs summarise the main points, after which they are compared and analysed.

1. Finland: There are three different support schemes, and these cannot be used simultaneously, as they are targeted for different purposes. The subsidies are meant for research, product development and investment.

2. Germany: As the feed-in tariffs are the main support means, subsidies are paid only for installation or extension of heat producing bioenergy plants. These installations can also get long-term, low-interest loans with a fixed interest rate.

3. Denmark: Energinet.dk grants subsidies for production, research and development of renewable energy. There are three different programmes Energinet.dk runs, and a biogas operator can benefit from more than one scheme.

All of the three countries' subsidy schemes are project specific and thus the amount of paid subsidies cannot be compared. However, the versatility and utilisation possibilities can be compared. Germany does not offer anything for biogas operator that does not produce heat. Finland has quite a good variety of schemes, but they cannot be utilised simultaneously, or "many times". Denmark also has a good variety of schemes, but one can benefit from more than one Danish programme.

Evaluation

As can be seen from the preceding chapters, all of the three markets have their positive and negative aspects. Whether one market is better than another, is based on a couple of criteria. First, it would be needed to determine which, the "lump-sum subsidies" or the continuous support provided by feed-in tariffs and premiums, have more effect on consumer behaviour. Installing a biogas plant requires a good amount of capital, thus investment subsidies could have bigger effect. On the other hand, the long-term financial security provided by the tariff system appeals to customers that are more long-term oriented. The author claims that both of these have an effect, and that consumers having both of these options are more willing to invest in a biogas system. Based on the previous notions, the author claims that Denmark is the target market with most potential of the three countries, solely taking into account the policies of these countries. The following chapter, Conclusions & Recommendations, combines the analysis of this chapter and the Chapter 3.2 and takes the analysis a step further.

5 CONCLUSIONS AND RECOMMENDATIONS

In this chapter, the previously presented data are analysed together and based on that, recommendations for the case company will be made. Both the market size data and the policy information are evaluated against the theoretical framework. The chapter concludes in suggestions for further research and the author's thoughts on the process.

As mentioned, the author recognises that for a thorough market analysis many more issues need to be studied in detail and no internationalisation decisions can be made solely relying on the results of this thesis. However, the results of this thesis represent the market potential of the studied countries. The market potential has been investigated by using the number of farms in selected countries. Table 5 below summarises the findings about Finland, Germany and Denmark.

TABLE 5. Number of farms in the selected countries.

	Cattle	Pigs	Poultry	Total
Finland	11 907	2 144	1 167	15 218
Denmark	15 620	3 610	280	19 510
Germany	169 680	28 740	9 010	207 430

The number of livestock farms is clearly the smallest in Finland. The Danish market is 28% bigger and the German market is almost fourteen times the size of the domestic market. As demonstrated in Table 6, if we assume that 20% of all farms would install a biogas plant and the case company had a 10% market share, it would mean the customer number of 304 in Finland, 390 in Denmark and 4149 in Germany. Based on these assumptions, the company can easily calculate the possible turnover and profit margin that can be achieved in these markets.

TABLE 6. Customer potential.

	Farms	20 % potentials	10 % market share
Finland	15 218	3044	304
Denmark	19 510	3902	390
Germany	207 430	41486	4149

The support policies in the three markets vary a lot. In Germany, the only real support instrument is the feed-in tariff while research and investment subsidies are close to non-existent. From biogas producers' perspective, the FiT is excellent; Germany was the second country in the world to introduce the tariff system thus they have had time to make it functioning. However, the author believes, that the FiT alone is not enough to encourage customers to make the investment.

Denmark and Finland have similar support instruments, if we count in the proposed Finnish tariff system. Both feed-in systems have provisions that can increase the amount of paid tariff. The principal amount of the tariff is however, very different: in Finland 34.91€ and in Denmark 100.1€. The subsidy schemes are principally quite the same, but in the Danish system, one operator can benefit from multiple programmes. In Finland that is impossible, as the different schemes are aimed for different operators.

Again, we arrive to the dilemma: which has bigger effect on customer behaviour, feed-in tariffs or R&D and investment subsidies? Installing a biogas plant requires capital, thus investment subsidies could have bigger effect. On the other hand, the long-time financial security provided by the tariff system appeals to customers that are more long-term oriented. The author claims that both of these have an effect, and that consumers having both of these options are more willing to invest in a biogas system.

The author believes that all of the three markets have great potential. The objective of the thesis was to outline and evaluate target markets for the case company and ultimately, to find out whether the market intuition is supported by the research findings. In this case, the market sizes and policies do not support

each other in a way that one market would be superior to another. Based on market size, Germany would be the option. Regarding policies and support instruments, Denmark is the most rational choice. Finland, being the domestic market, is obviously a good starting point.

Based on the preceding notions, the most rational choice would be to start in the domestic market, Finland, and begin extensive brand building measures. As the Finnish policies are about to change, the interest towards effective and feasible RE technologies is expected to grow. While the support measures and general interest increase, the customer willingness to install biogas plants could be predicted to increase as well. However, the author recommends that to determine the "absolute" best target market for the case company, more research should be conducted.

5.1 Suggestions for Further Research

As this research was only a screening of the possible target markets, there is a vast amount of subjects for further research. Two main approaches could be identified: further research for the case company and further research on related issues, but not regarding the case company. The research for case company has two directions, domestic and international.

Regarding the domestic scope, the author recommends customer surveys as the next step. A survey could be made of farmers already operating biogas installations, aim in defining motives behind the investment and experiences on the technologies they have used. Another survey could be made for farmers that do not have biogas installations. In that survey, general willingness to invest on technical appliances alongside with factors that would get them to invest in a biogas plant could be determined. The acquired information could be used in R&D and marketing. In high-tech markets, the brand is a very important issue and thus efforts should be made to build it as strong as possible.

The international aspect is rather obvious. The screening done in this research could be deepened by country-specific analysis. First, the potential customers should be segmented and the desired market position clarified. The complete operational environment should be investigated including the competitors, regulations and customers' purchase power and patterns among others. The best-suited market entry modes should also be examined. These aspects, excluding the entry mode, should also be investigated regarding the domestic market.

Further research on related issues, but not regarding the case company could be for example testing the market intuition of company decision makers on a wider level. It would be interesting to see, how much of the decisions of Finnish SMEs are done solely relying on intuition. Though in this case the intuition was supported by the research findings, the author highly doubts that not being the case most times.

The listed suggestions are only a small part of the aspects that could be further investigated. However, the author strongly believes that the domestic, German and Danish markets would be worth examining in more detail. All of the countries have potential, and the potential should be harnessed in the best way possible.

5.2 Thoughts on the Process

The writing of this thesis has been challenging at times due to the nature of the needed information. The amount of livestock farms proved to be much harder to find, than the author initially believed. The problem with using secondary data, as mentioned in the theoretical framework, is that it is usually not in the form the researcher would need it to be. This proved to be just the case in point. The author approached officials from the countries' statistical offices in hopes of acquiring the information through these channels. Unfortunately, that came to no use as the countries did not either, prepare the needed data, or provide it without a charge.

The policies are a chapter of their own. One needs to consume a tremendous amount of time just to comprehend the official, and better yet, legislative texts. Another issue is the processing of the Acts and Decrees into an understandable, yet specific enough output. Consideration of the "Who am I writing this for?" was a topic to ponder upon. On the other side is the case company, with knowledge on the issue and terminology, and on the other the reviewers of this work in its essence, as a thesis. Combining these two aspects in terms of language, structure and studied topics was a bit of a challenge. Confidentiality issues were also ones that hindered the process to a certain extent. However, the author believes that the outcome is one that pleases both target audiences and that the set objectives are met.

Though containing some difficulties, the author still finds the research subject and the whole process very interesting. As mentioned in the first pages of the thesis, the world is now at a crossroads of making sustainable decisions, and it truly is exciting to observe the decisions that are made worldwide. Especially with the little insight gained from this process.

6 SUMMARY

The aim of the thesis is to outline target markets and their potentiality for a biogas company to be founded in the near future. The process started with familiarisation with the biogas industry. The author studied biogas related aspects before designing the research structure in order to have knowledge on the existing information. The thesis is divided into two parts, the theoretical and the empirical.

The first part of the thesis is the theoretical part. This part deals with various sources of literature concerning market research and selection. The objective is to give a background on how to conduct market research, what are the approaches, methods and how the process should be structured. Regarding the market selection process, the data presented have special emphasis on high-tech markets. Implementation of the theoretical part affected the research structure so that it follows certain general market research guidelines.

The second part of the thesis is the empirical part. The research is divided into two phases. Seven countries were to be investigated in the first phase, Chapter 3, based on market size. After analysing the countries, three of them were selected for the second phase of the research, in which the objective was to find out the relevant policies, and more precisely, the support instruments of the three countries. The final three countries were Finland, Germany and Denmark.

The research is a case study. The empirical examination was mostly implemented as a desk research, using secondary sources of data. Support for the findings and their analysis was acquired through theme interviews with the case company. By these interviews, the goals and perspectives of the commissioning company could be clarified. Though being a desk research, market intuition of the case company had a major impact on the selection of the countries. The aim of the process was also to test the validity of their market intuition, whether it is accurate or not.

Findings of the research show, that the market intuition in fact is valid. The seven initially selected countries showed positive signs regarding the market size. Four of them had to be eliminated from further study in this research. The criterion for elimination was acquired from the theoretical framework of the thesis.

To conclude, the author recommends the further exploration of the domestic market as the next step. All of the examined countries have their potential, but the author believes that the potential of the domestic market ought to be harnessed, before entering foreign markets. As all of the markets were prospective, suggestions for further research are made in the end of the fifth chapter.

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