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Commodities

Commercialization of the Remote Sensing Technology in the Biodiesel Sector

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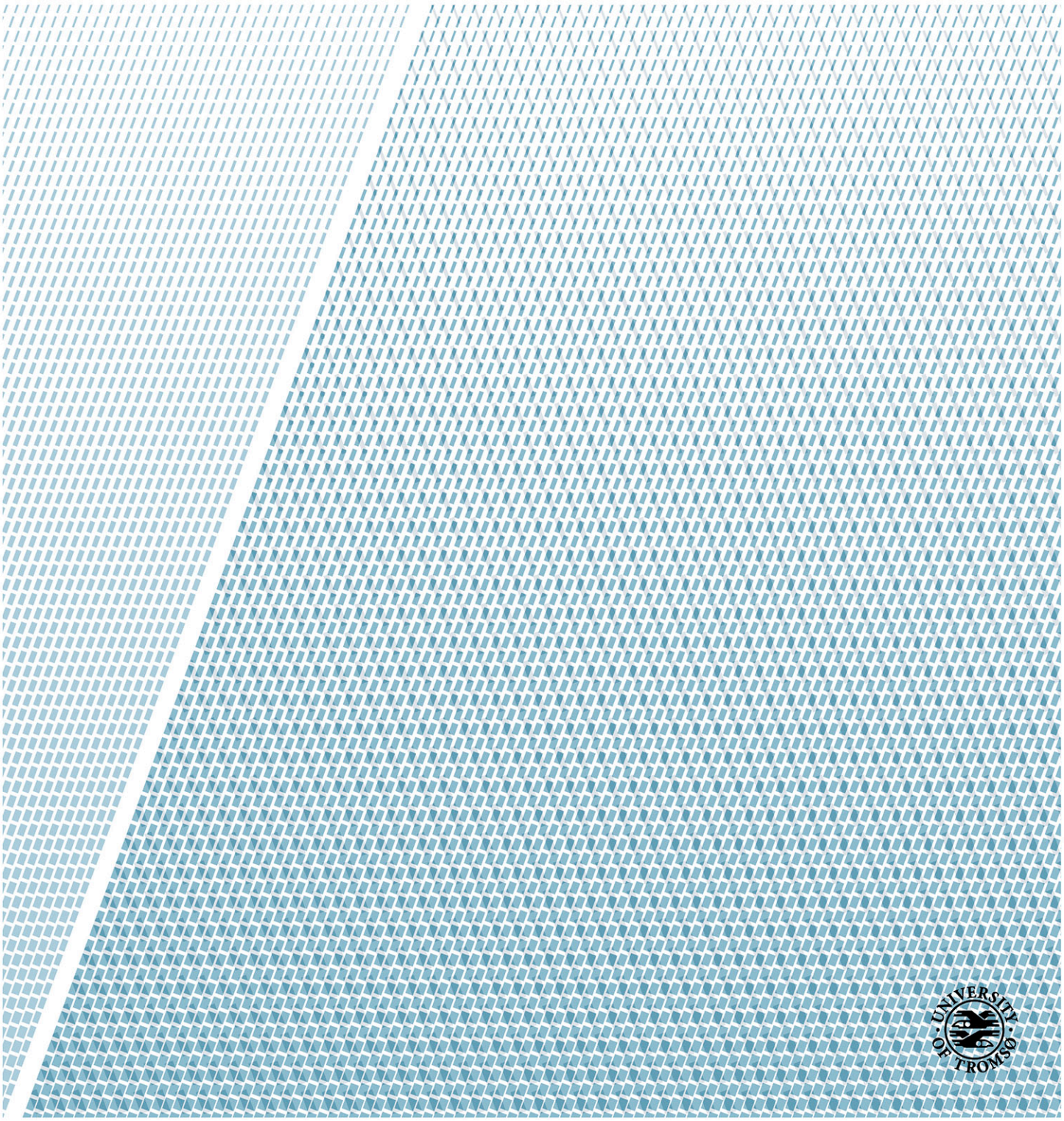
Master's Thesis in Business Creation and Entrepreneurship – June 2016



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ABSTRACT

In relation to climate changes that caused by human activities, developments of the "green" industries are becoming incredibly important. It primarily concerns the substitution of petroleum products to biofuel. To make substitution process faster, the biofuel industry should be profitable rather than being heavily subsidized by state as of now. For this purpose, the industry needs innovative solutions and technologies, which can be also provided and commercialized by academic institutions. In this regard, the present Master thesis examined the feasibility of the remote sensing technology commercialization in the biodiesel sector as an innovative tool and represented successful example of collaboration between industry and university. A case study approach has been employed in this thesis in order to develop the new service, which is based on the existing technology. The remote sensing technology has been using from the latter half of the 20th century in many areas, namely Earth observation, maritime surveillance, the weather forecast and agriculture. This technology ensures a wide range of the different data that helps to foresee the future changes and, consequently, make the right decisions. For this reason, commercialization of the remote sensing technology has been investigated and resulted in the background to the development the new service with the working name "Inquire the quality" or IQ. Taking into consideration that the project was initiated by UiT, The Arctic University of Norway, this Master thesis has employed theoretical knowledge in conjunction with the business approach that paved the way for the start up establishment in order to launch the innovative tool on the biodiesel market.

GLOSSARY

GPS- Global Positioning System- is a radio navigation system that allows determining exact location during 24 hours a day, anywhere in the world, in any weather conditions.

High Performance Extraction (HPX) is normalizing the imagery for changing or spatially variable atmospheric conditions.

Leaf Area Index (LAI) is a value that characterizes vegetation cover.

Moisture content (mc) of the seeds is the moisture content of the seed. It is usually expressed as a percentage.

Optical satellite image is an image taken by the satellite.

Photosynthetic active radiation (PAR) crop parameters - is a parameter of the radiation absorption by crops and has been used to model plant growth.

RADARSAT-2 is an Earth observation satellite that is the one of the major data source for commercial applications.

UAV- Unmanned Aerial Vehicles.

USV/UUV/R- Unmanned Surface Vehicles, Unmanned Underwater Vehicles or other Robots.

Vegetation index represents a combination of surface reflectivity that intended to highlight particular features of vegetation.

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1. INTRODUCTION

Many universities around the world focus on opportunity that comes from the academic entrepreneurship (O'Connor, Graff et al. 2010). Academic entrepreneurs were defined as entrepreneurs, who begin from the “pure academic” and implement the entrepreneurial efforts to come to the individual with both science and business characteristics (Dickson, Coles et al. 1998). The majority of the current researches describe academic entrepreneurship as a commercialization of the university inventions. A broader view allows describing this phenomenon as a "venture creation opportunity" that based on the academic participation (Lundqvist and Middleton 2013).

In order to transform an existing service to the innovation, *UiT The Arctic University of Norway* in conjunction with the *Kongsberg Satellite Service AS (KSAT),* have presented the remote sensing technology for the purpose of this study case. Findings are used to construct the innovative service, which is based on the agricultural, economical and logistical parameters extracted from the satellite images and has working name *"Inquire the quality"* or simply *IQ*. This case has been considered by the student in her final semester of a Master’s of Business Creation and Entrepreneurship (BCE) with the purpose of commercializing the remote sensing technology within the biodiesel sector. This thesis also reveals some limitations and complexity during the collaboration between academic and business community that can be a basis for the future research.

1.1. THE IMPORTANCE OF THE TOPIC

Recent economic trends and emerging global financial crisis require new solutions and innovative approaches. In this regard, universities with their scientific capacity can play an important role in the formation of a sustainable economy. Indeed, most of the educational institutions are focused on the education and research but some of them implement "the third mission" (Foss and Gibson 2015). Therefore, it highlights increasing importance of the commercializing innovative ideas and creating supportive infrastructure for the spin-offs. However, business development requires investing huge amount of different resources and faces with numerous challenges. For this purpose, universities provide unique opportunities to build the new innovative business through academic entrepreneurship. Thereby, both entrepreneurs and researchers are able to make contact and find a practical application of scientific development. Furthermore, they receive the opportunity to start spin-off and, during

the process, contribute to development of social capital (Borges and Jacques Filion 2013). This is especially valuable for the Business creation and entrepreneurship (BCE) students, in terms of future development of the business ideas of the master thesis. Regarding the business idea, which is presented in this Master thesis, the support from the university and the network strategy may play crucial role in successful development of the innovation.

Nowadays, the common trend in the commercialization of university-generated knowledge is the interaction between academic institutions, which provide new technologies and commercial firms that launch it in the market (Goldfarb and Henrekson 2003). However, the Business school at UiT The Arctic University of Norway implemented the other way of the innovative ideas commercialization. The Kongsberg Satellite Services (KSAT), which works with the remote sensing technology in the maritime and oil industry, has provided the idea for this Master thesis in order to find the new market and transform the existing technology in an innovative service. For this purpose, the "packaging approach" to idea evaluation has been applied. Accordingly to Alänge, S., and Lundqvist, M. (2010), we have made the "giftwrapping" of the idea in order to find the new destination to existing technology with the purpose to drive sustainable development and open up the new market. Thus, during the work on this Master thesis we have discovered the new promising market for the remote sensing technology, created the necessary conditions for the setting up the company and implementation of the pre-pilot project. Thereby, the result of our work confirms the relevance of cooperation between business and universities, even if the idea originates from the commercial company.

1.2. TRENDS THAT LED TO IQ SERVICE

The climate changes and limited resources of the crude oil lead to the growth demand on the renewable energy resources. For this reason, utilizing alternative fuels can solve this problem. Biofuel is the fuel, which has a bioorganic origin. There are different forms in which we can obtain biofuels (Demirbas 2007). One of the most consumed in Europe is *biodiesel*. Biodiesel is environmentally friendly type of the diesel that is used for compression-ignition engines and have many advantages, like non-toxic, biodegradable and non-flammable (Bajpai and Tyagi 2006) characteristics. However, production of the biodiesel has many challenges, which require innovative solutions. Taking into consideration that the cost of biodiesel is the main obstacle to the widespread use of the product, the biodiesel producers need an effective tool in order to decrease production costs. The raw material costs constitutes more that three

quarters of the operating costs (Demirbas 2007). However, it is possible to decrease these costs, if the biodiesel producer knows the qualitative characteristics of the certain harvested area before signing a contract for the raw materials supply. Consequently, the better quality of the raw material, the lower operating costs. For this purpose, the remote sensing technology can be introduced in the biodiesel market as an innovative tool. In the context of the launching the new service in the market, the service development should pass through the certain stages before it can be implemented in the biodiesel sector. As articulated by Jolly, V. K. (1997), the commercialization of the new technological ideas can be challenge and has to go through nine stages accordingly to Jolly's overlapping stage-model. This Master thesis aims to consider the first stage of the Overlapping Stage Model for Technology Commercialization, namely "Imagining".

1.3. RESEARCH QUESTIONS

According to commercialisation scholars, there are three important elements of successful product development, such as: process, strategy, and resources. These factors strongly affect the new product or service and determine the key success drivers of the commercialization process. In this regard, the early product definition, close communication with potential customers, fast decision making process, true cross-functional team and focus on quality of execution are the crucial success factors in development of the innovative high quality product (Cooper 1996). Thus, the new product development should pass through several stages in order to be delivered in the market (Jolly 1997). For this purpose, the technology, its innovativeness, the market needs, opportunities and limitations should be investigated. As a result, business concept and strategy should be developed; thereby, answering the main research question.

The first step in case study is to define the main problem of the research. For this purpose, the researchers usually focus on the forming of the research questions, which determine the main purpose of the study and highlight the main issues. Each issue can be described in terms of economic, political, historical or ecological aspects, investigating the object of the case study and answering the research questions. It can be done via answering "why" or "how" questions in order to investigate the object of the case study. In this regard, the researchers have to conduct a literature overview to be able to formulate the question and find the main research problem. Thorough literature study enables to determine the methods of analysis that will be used during the research. The allocation of the main research problems, determination of the

potential audience and precise definition of the main research goal have direct impact on the design and the achievement of the objectives of the study (Soy 2015). In this case, the objectives are to define the market with the largest potential for the satellite technology and the ability to output the remote sensing technology in the market. Consequently, the topic of this Master thesis is "Commercialization of the remote sensing technology in the biodiesel sector" and, respectively, the main research question is

"How to commercialize the remote sensing technology in the biodiesel sector?"

However, before we have started working on the Master thesis, it had been necessary to find the answer to the prior question:

"Why is the biodiesel market the most promising market for remote sensing technology?"

in order to define the main research question. For this purpose, several potential industries have been analysed. The biodiesel sector has been chosen because it has a big potential, needs in the data from the satellite images and support 'green' business opportunities (Alänge and Lundqvist 2010).

1.4. INNOVATION STUDY

Invention needs to go through the commercialization process to become an innovation (Aarikka-Stenroos and Sandberg 2012). O'Sullivan and Dooley (2008) defined an innovation *"the process of making changes, large and small, radical and incremental, to products, processes, and services that results in the introduction of something new for the organization that adds value to customers and contributes to the knowledge store of the organization"*. As a matter of fact, commercialization of the innovation is not only the process of the launching the new product. It also requires sustainability that possible to achieve through the network by good integration with the actors who create the value of the new product. In other words, the commercialization of the innovative product can be described as the scheme: "An Idea—Applies—To Create Benefit" (Gurr 2001). However, commercialization process cannot occur by itself. As articulated by Vohora (2002), in order to commercialize the technology or new idea is necessary to add entrepreneurial capacity (Vohora, Lockett et al. 2002). In this regard, partners and interested persons need to have the technology evaluation in order to make

decision about investments (Alänge and Lundqvist 2010). For this purpose, the Innovation study investigate the following research question:

"How can the existing remote sensing technology become innovative for a new market?"

The Innovation study provides the overall insight of this question through the answers on the other sub-questions. The first sub-question touch upon technology, such as:

"Which advantages the remote sensing technology has over other tools?"

Following the Alänge, S., and Lundqvist, M. (2010), it is important to know, which advantages the new product can deliver to the market in order to achieve sustainability. This knowledge allows creating the design of the innovation model and clarifies the technological complexity. Such analysis provides valuable insights into strength and weaknesses of the remote sensing technology and helps to allocate the utilities that, as a matter of fact, are reflected in the following sub-question:

"What kind of utilities and limitations has the remote sensing technology?"

These sub-questions have been investigated in the first two sections of the Innovation study and represented as idea evaluation. Accordingly to the Alänge and Lundqvist's (2010) framework, the idea evaluation has been broken into two sections, such as:

1. The remote sensing technology evaluation and description, which outlines the technical description, comparison the IQ service with the alternative ways of producing a utility, novelty and freedom to operate, team structure and the next step.

2. Customer's utility that highlights situation of use, societal, business and customer utilities, and limitations. The utilities reflect the needs and problems of the potential customers and potential benefits that can be received. Indeed, it is important to realize if the remote sensing technology can solve the problems that biodiesel producers have or fulfil some needs. An equally important factor is the opportunity to meet the social needs, which results in attracting new investments in plant and equipment, creating new jobs in the rural areas, and, as a result, growth of the income taxes (Demirbas 2007). In addition, the remote sensing technology indirectly impacts the ecological factor. This is relevant for the situation, when the biodiesel producers can obtain reliable data about the quality, quantity and location

of the feedstock and, hence, decrease the price on the biodiesel that cause the replacement of the diesel by biodiesel. This will eventually lead to the reduction of CO_2 emissions.

The last two sections of the Innovation study represent the position of the remote sensing technology on the Innovative map and have answered the following sub-questions. The third question is:

"What is the innovative potential of the remote sensing technology and which place does it take on the innovative map?"

This section provides the insight into the basic concepts, such as: innovation; innovativeness of the remote sensing images from the micro-, and macro perspective; analysis of the remote sensing technology as disruptive or sustaining technology. It also describes the remote sensing technology as an innovative tool for the biodiesel market. At the end, it defines position of the remote sensing technology in the market due to novelty, displays its location on the innovation map and outlines challenges and opportunities in the market.

The last sub-question is:

"How will the remote sensing technology affect the biodiesel market?"

This question follows from the previous one and closely interrelated. The third sub-question leads to understanding the precise position of the remote sensing technology in the market, which, in its turn, is necessary for selecting the marketing strategy. However, our findings should be supported into a wider range of market analysis by research of the challenges and opportunities for the application of the remote sensing images in the biodiesel market. Thereby, insight into impact, which the remote sensing technology will have on the future of the biodiesel market, makes it possible to adjust the ways of the product development that, in turn, are closely linked to the position of the technology in the innovative map.

Hence, the third and fourth sections determined position of the remote sensing technology in the market due to the novelty and defined it as radical, really-new and incremental, namely:

3. The innovativeness of the IQ service and position of the remote sensing technology on the innovation map section displays the technology location on the innovation map.

4. The impact of the remote sensing technology's position on challenges and opportunities at the biodiesel market section outlines the issues and benefits we can face during the commercialization proses.

1.5. MARKET STUDY

Market identification is also one of the issues of the commercialization process. The product can be recognized as a very promising but launching in the market can be unsuccessful. This can happen for many reasons, and one of the most significant is wrong selected market (Aarikka-Stenroos 2012). In this regard, the market should be investigated properly before the company will make decision to introduce the product. This issue is particularly relevant in case of remote sensing technology. In the very beginning of the work on Master thesis, we have just the technology and the goal to apply this technology on the new market, where it has not been used before. In this regard, the biodiesel market has been chosen. However, we had to find the answer on the most important question:

"Why does the biodiesel market need the remote sensing technology?"

In order to understand if the biodiesel market has needs in the remote sensing technology, we investigated the European biodiesel sector and investigated unsolved problems, needs and issues in the biodiesel sector. Currently, the market situation is changing faster the ever before and demands timely reaction and modification that may be carried out by means of a business strategy (F.M.E. Team, 2013).

" Strategy is the direction and scope of an organization over the long term, which achieves advantage in a changing environment through its configuration of the resources and competences." (Johnson, Scholes et al. 2008)

In this regard, we have used special framework, which describes the offered strategy for the IQ service and represented below.

MARKET ANALYSIS

In order to make the problem statements, we investigated the life cycle of the market and the main market players. In this regard, we clarified how big and potential the biodiesel market. We estimated the attractiveness of the biodiesel market in biofuel industry, allocate the

region, where we have to start and specify the actors, which can be potential customers of the new service. We have targeted several market segments that can be attractive for the IQ service. However, we have focused on the biodiesel production due to the fact that it is very narrow segment that has particular needs. Taking into consideration the resources and team that work with IQ service, we evaluated the sales potential of the segment in terms of customers' number and attractiveness of the segment. To reduce the risk of losing money when entering a new market, we find the growing potential of the market, perfect time to start the pre-pilot project and segment profitability. The marketing analysis allowed formulating a strategy on how to start and run the business. By taking into consideration the market knowledge, analysing competitors and choosing the strategic tools, we created particular market strategy in order to make the IQ service profitable and sustainable.

COMPETITOR ANALYSIS

Each company has a unique market profile, which includes a pair-wise comparison with existing and potential competitors (Chen 1996). Understanding the competitive advantages and disadvantages of the new service is one of the key success factors that establish what makes the service unique. In this regard, we investigated potential competitors, internal and external environmental factors that can influence the IQ service. Understanding the competitive advantages and disadvantages of the new service is one of the key success factors. Comparison of competitors' services with our service allows establishing advantages that makes the IQ service unique and identifies, which features enable to attract customers. We began with identifying present competitors and identified the technologies, which can be potentially competitive. In this regard, we specified three potential competitors that satisfy the market demands and found out their strong and weak points compare to the IQ service. Finally, competitors' analysis was the basis for the formulation of the effective strategy. Careful selection and analysis of competitors will allow developing, selecting, and testing appropriate strategies (Zahra and Chaples 1993). During the commercialization of the IQ service, the formulated strategy should be implemented in consideration of further strategic moves by competitors.

MARKETING MIX STRATEGY

Marketing mix is a conceptual framework that associated with determination of a product offer and based on four P's: price, product, promotion, and place. This marketing tool is

relevant for both long-term strategies and short-term programmes (Palmer 2012). In our marketing mix strategy we focused on the service and did not consider the customer's behaviour because 4P's is internally oriented tool (Goi 2009). However, some scientists argue that successful strategy should prioritize the customer and must put on the first place the customers' needs (Lauterborn 1990). All these views are relevant for the particular stage of the service development. Indeed, we have created the innovative solution that based on existing biodiesel producers' needs, which has been investigated properly. But we should understand the marketing properties of the service in order to introduce it on the biodiesel market. That is why the 4P's is a perfect and simple tool for this stage of the service development.

SWOT ANALYSIS

Originally a SWOT Analysis is a strategic planning tool that used to evaluate the Strengths, Weaknesses, Opportunities, and Threats. In this thesis the SWOT Analysis is not applied to particular company. It is applied to the innovative solution, which based on the remote sensing technology. SWOT analysis is a powerful tool, when it comes to the assessment of the factors that affect the service. In order to understand the influence of the internal factors, Strengths (S) and Weaknesses (W) have been analysed. External factors have been investigated in the Opportunities (O) and Threats (T) sections. Such analysis provides valuable insights into capabilities and resources, which organization has. Moreover, SWOT Analysis is just a first step before more advanced and complex analysis. Using SWOT Analysis, we should be aware about the limitations of this tool, like the risk of oversimplification and risk of using not relevant information, because the clear borders of the SWOT Analysis can not be determined (F.M.E. Team, 2013). Taking into consideration the development stage of the IQ service, we can conclude that SWOT Analysis is ideally suited for this case and will be used in order to build the marketing strategy.

1.6. BUSINESS PLAN

When an entrepreneur or group of entrepreneurs start the venture, they have to understand the gap between already existent resources and those that are needed for the start-up. As was stressed by scientists, identifying, specifying, combining, and transforming personal resources into the new business are the main entrepreneurial challenges that can be faced (Brush, Greene et al. 2001). In this regard, the mission and vision should be clarified in the

very beginning of the commercialization process in order to show the unique characteristics of the company, which differentiates it from others (Taiwo, Agwu et al. 2016). Poorly written Vision and Mission statements will lead to decreasing productivity and do not allow leveraging all resources for a business idea implementation. Furthermore, understanding of the business idea will assist identifying the priority aims and create the viable business model. All these business parameters are strongly depend in the marketing components, such as: customers' needs and their willingness to pay for the solution, market conditions, logistic, market regulations, limitations, market intensity and the number of similar products in the market. Adequate evaluation and complete analysis of these marketing components enables to develop the reliable marketing strategy and make the marketing plan (Zinkhan and Pereira 1994). At the same time, awareness of the benefits of the new technology over the similar products allows establishing a company that will bring to the market not just a new product, but also the ready solution to the existing market problems. No doubt, the company needs the creative and cross-functional team with diverse experience to be able launching the new solution to the market. The team can be represented by the owners and their partners during the early idea development stage and will be transformed into organizational structure later on. In terms of the successful commercialization, the overview of the economic situation, cost structure and budget are the cornerstones of the successful product development. Furthermore, understanding and planning of the financial parameters allow distributing existing resources rationally and use them in the most efficient way. In addition, the economic overview enables assessing the necessary investments and find exiting strategy.

The detailed analysis of all of the above indicators provides the answer to the main research question of this Master thesis, namely:

"How to commercialize the remote sensing technology in the biodiesel sector?"

1.7. METHODOLOGY AND DATA COLLECTION

Before research will be started, it is important to be clear about the design and purpose of research. The study needs a design or, in other words, a clear structure before data will be collected and analysed. Following De Vaus and de Vaus (2001)

"The function of a research design is to ensure that the evidence obtained enables us to answer the initial question as unambiguously as possible".

Such definition is relevant for the understanding the difference between research design and method by which data are collected. Indeed, we should be clear that the research design is a logical structure of the inquiry, while the methods should be referred to a mode of data collection. Case studies usually employ qualitative research and utilize an interpretive approach to data. It means that this type of studies focus more on the subject within its context and take into account the subjective meanings and experience that people have (De Vaus and de Vaus 2001). In this case, the case study is the type of design, which we use to analyse particular service. Case study approach is based on the investigation in depth of the particular event or object (the service in our case) and bounded by time and activity. This approach allows to collect and analyse the variety of data during the certain timeline (Creswell 2013).

Touching upon empirical context of our case, this thesis employs a qualitative single case study approach to examine a real life context of the existing technology (Yin 2013). The initiative was originally created by the Business school at the Arctic University of Norway and KSAT, which provided the remote sensing technology. It resulted in the development of the single case, which reflected in the theme “Commercialisation of the remote sensing technology in the biodiesel sector". Adopting case approach allowed to author making a fieldwork by working "face-to-face" with the companies leaders and potential competitor, which is especially valuable when it comes to the needs and issues that firms usually face with. In this regard, the qualitative case approach allows "to see how the issues work out in practice" (Simmons 2008).

Touching upon methods of data collection, we should list them. There are Questionnaire, Interview (structured or loosely structured), Observation, Analysis of documents and Unobtrusive methods (De Vaus and de Vaus 2001). In view of the specific type of case study upon which this thesis focuses, many of the methods that were mentioned above have been employed. A range of documentary evidence, two semi-structured face-to-face interviews, consultations with technical team and Internet searching formed the basis of the empirical work for the case study. The documentary analysis has been performed investigating the secondary data in scientific journal articles, research papers, commercial documents, books, magazines, and reports. The legislative acts gave the valuable insights about the rules and regulations on the biodiesel market. The main goal of the secondary data searching was to understand the biodiesel market trends, regulations and identify existing problems. The

received information was used in the Marketing study and, further, in the Innovation study. It was the basis for preparing of the interviews and consultations with the technical team in order to find out whether the technology can provide the necessary data. The secondary data has a high range of the credibility because it has been analysed and interpreted by the team of co-workers, which is especially important when the Master thesis is written by the student alone.

Semi-structured face-to-face interviews are to be conducted with the CEO of the Biodiesel plant in Lithuania and the potential competitor's employee in USA. The open questions were used in the interviews, which have been conducted via Skype. The interviews confirm the secondary data statements and existing market needs. The organization of the interviews was really a big challenge in Europe because of the language barrier, the lack of experience in collaboration between biodiesel plants and universities and classification of the requested data as a commercial secret. This stance is reflected in the interviews and Internet/site visit data.

1.8. LIMITATIONS

The complexity of the external reality makes some limitations of a researcher's capacity when it comes to refining the assumptions (Perry 1998). This is particularly relevant when the student write the Master thesis alone and restricted with time framework. The work on this Master thesis consisted from two stages, such as: the preparation to the writing (the first two month) and writing period (four months). One of the limitations was caused by necessity to find the market for the existing technology. In fact, it was not clear on the first stage how the remote sensing technology can be applied to the other field. Indeed, focusing on the biodiesel market, we can miss more valuable opportunity for this technology. It may happen also because the author's technological background and knowledge are limited and rely to the business field.

The other issues concern the fieldwork limitations. It was a challenge to find the persons, who want to share the information, which they defined as "commercial secret". The language was another limitation. That is why the interview in Lithuania was conducted in Russian language and then translated for the purpose of this thesis. For the same reasons, we managed to have the interview just with one potential competitor.

Lastly, this Master thesis is based on the many assumptions about the demand on the service and the technical implementation of the idea. Moreover, the financial part of the Business plan based on the secondary data and hypothesis, which have been made after the interviews. That is why we can recommend employing the pre-pilot along with pilot project in order to confirm and correct the assumptions.

1.9. SUMMARY AND REFLECTIONS

This Master thesis has been focused on the importance of the collaboration between the commercial enterprises and universities, which was considered in a view to understanding the potential opportunities and challenges in terms of the idea commercialization. In this regard, the University plays crucial role in the knowledge transfer, network creation and supportive programs. This thesis stressed on the importance of the academic entrepreneurship due to collaboration between students, researchers, professors and special university departments that assist to transform invention to innovation. Such approach provides valuable insight into the economic and society as a whole through highlighting governmental programs and special focus on the commercialization of the innovative ides.

The topic of this Master thesis represents a business idea that may be applicable in the biodiesel sector worldwide. This idea is really innovative and incredibly complex. Based on the fact that in the very beginning of the work the product and market were unknown, we tried to create as broader network as possible in order to find the new application for the existing technology and investigate it. For this purpose, we gathered the information that could provide the opportunities to recognize the needs or problems of the market players. We were able to narrow down the searching area and find the opportunity to choose the certain scope of the market for launching the new service. On the other hand, we managed to discover, which type of the information from the satellite picture can benefit potential users. Hence, we have defined the potential customers, their problems and biodiesel market needs.

The remote sensing technology was introduced by KSAT, which takes the leading position on the satellite service branch. The main research question “How to commercialize the remote sensing technology in the biodiesel sector?” has been answered using a study case approach. In order to answer this question, we evaluated the level of readiness of the remote sensing technology for the biodiesel market, the biodiesel market size and potential, main market actors and their needs, competitors, resources that we have and need to obtain. This

information became a basis for the strategy and business plan, which are the answer on the main research question. Moreover, we were able to make the theoretical framework of the further idea commercialization. In this regard, we supported the main research question by sub-questions, which have been revealed in Innovation study, Marketing study and in the Business plan.

The Introduction (chapter 1) of this thesis outlines the context of this thesis. The importance of the topic and research question have been described explaining the background and framing the design area. The methodology and limitations are represented as a set in order to frame the specific target of the case study. The chapter is closed with reflections on this case. The Innovation study (chapter 2) highlights the unique opportunities for the remote sensing technology on the biodiesel market and describes how existing technology can became really new for the different markets. The Marketing study (chapter 3) introduces the main needs, problems of the market that allows understanding if the technology can fulfil it. Another important mission of the Marketing study is to find the market players, who are willing to pay for the new solution. All of these findings subsequently formed the basis for the financial calculations in the Business plan (chapter 4). Actually, the Business plan is a written plan from an operational, organizational, marketing and financial viewpoint, which is finished with Execution part.

This work resulted in establishment of the team, which applied for the financial support to The Research council of Norway in order to set up the start up company and carry out the pre-pilot along with pilot project.

2. INNOVATION STUDY

The biodiesel sector has appeared as a "green option" on the diesel market and can be considered as the alternative to fuel in order to reach sustainability in the power sector. In this regard, the assessment of the major parameters of the biodiesel industry is a key factor of the stable growth and sustainability of the branch. For this purpose, economists use the different tools that allow predicting events. However, some tools eventually lose its novelty, and are replaced by the new technologies. The idea to use *remote sensing images* in the biodiesel sector has arisen regarding the possibility to present a completely new tool to the biofuel market, which has a capability to offer prognosis of the higher accuracy. The data, which is obtained from the satellite images, is widely used nowadays in many areas. However, it is innovative solution for the biodiesel sector and particularly for the biofuel producers. This section aims to investigate if the technology and service, which based on this technology, are *ready to be introduced* on the biodiesel market; what is *the innovative level* of the new service; what is the *customers value and utility* and which steps should be done before the service will be launched in the market.

2.1. THE REMOTE SENSING TECHNOLOGY EVALUATION AND DESCRIPTION

In the context of the sustainable idea development, the technology evaluation and description play important role and help to understand how the technology can be employed. In view of the alternative technologies, the remote sensing technology has some advantages, which are described further and provide the valuable insights about the future development prospects. Novelty and Freedom to operate section underlines the innovative solution, specify the novelty and determine the legal aspects of the IQ idea. Finally, the Next step is drawn, with suggestions offered for the further idea development.

2.1.1. TECHNICAL DESCRIPTION

A set of specific characteristics related to spatial, spectral and temporal resolution is required in order to use image-based remote sensing technology. For instance, the most precision farming applications require imagery with a spatial resolution better than 5m, multi-spectral imagery and near-real time images delivery (usually it takes 3 days) (Metternicht 2003). In this regard, KSAT has significant competitive advantage. The company can have around

fourteen passes of high resolution images per day just on the Svalbard ground station. It is important to mention that Earth is turning around the satellite.

The remote sensing images production has to get over several steps. In order to provide the high-resolution images, most imaging satellites operate at an altitude around 700 kilometers. There are Ikonos, Quickbird, Worldview-2, RapidEye and Spot-6 (Satellite Imaging Corporation 2016). In average, an image swath covers about 18 km in width. However, with an eye to the good quality images they need to be taken when the sun is high in the sky over the shooting area. The weather conditions play important role as well. The quantity of the images are restricted by onboard storage, which is limited. The next link in the chain of this technology is the ground station, which receives the information from the satellites. KSAT does not own the satellites. The KSAT has an antenna park (60 antennas), which is represented by a global ground station network consisting of both polar and mid-latitude stations. Then, the received data is processed and analyzed.

For the purpose of this thesis, we consider the last stage of the technology and create the new service (further IQ service or IQ), which is based on the received data from the satellites. The production of the IQ service consists of several stages. On the first stage we receive from the KSAT special "index", which we position on the map on a chosen area. After obtaining the necessary data about crop's and weather conditions we calculate the required parameters (like productivity of the rapeseed, biomass estimation, best harvesting time and yield) and deliver this data to the customer via application (app).

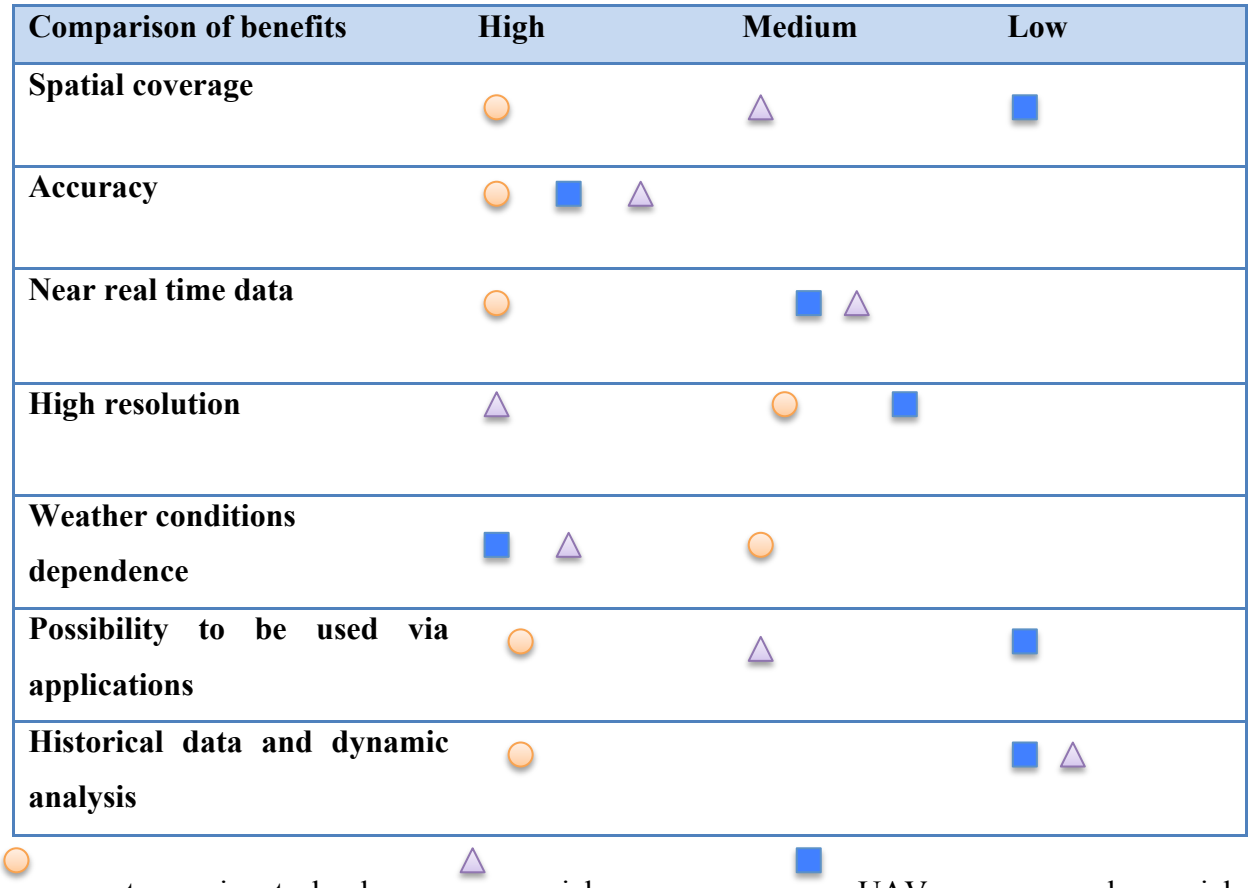
2.1.2. COMPARISON THE IQ SERVICE WITH THE ALTERNATIVE WAYS OF PRODUCING UTILITY

There are several competitive technologies, which can provide the similar utility to biodiesel producers like the aerial survey and unmanned aerial vehicles (UAV). The aerial vehicles, as well as satellite-based remote sensing technology, facilitate different types of measurements, such as: image-based, infrared and acoustic. The aerial survey generally ensures more detailed spatial resolution than satellite measurements. However, the area coverage cannot be such a global as via a satellite mission, albeit it is a bit larger than can be covered with the UAV (Sanders and Masri 2016). The fundamental difference between these technologies lies in the covered distances, volume of the received data and in the cost of the services. The

detailed comparison of the potential benefits from each technology is presented in the Figure 1 below.

The competitive analysis of the technologies shows that remote sensing technology has competitive advantages almost in all areas, especially when it comes to data collection across large areas. Nevertheless, the remote sensing technology applies in conjunction with areal survey and UAV in some situations.

Figure 1: Comparing the relative benefits of various test methods (subjective evaluation based on the author's opinion).



remote sensing technology; aerial survey; UAV: unmanned aerial vehicles (drones)

2.1.3. NOVELTY AND FREEDOM TO OPERATE

The remote sensing technology is not a new technology and it has been already using in many areas, such as: maritime surveillance, the weather forecast and agriculture, where it is known as Precision Farming. At the same time, the satellite technology is not in use in the

biodiesel sector that makes it novel for European biodiesel or rapeseed oil producers as well. The rapeseed producers usually receive the agriculture data by making samples from the field. Then they declare this information and the biodiesel producers use it afterwards. It takes a lot of time and has not got a high accuracy. The IQ solution solves this problem due to all the positive sides of it. First of all the received data can be updated every day and provide the full picture from the chosen area. The data has a very high accuracy and does not demand from the biodiesel producers to put an extra effort in order to receive it. Moreover, the data can be received from the any part of the world that open the new opportunities to find the raw material of the better quality and keep control on it before the harvest. Therefore, the novelty exists in regards to the market and customer.

For the purposes of the pre-pilot and pilot projects and accordingly to the agreement with KSAT, the IQ will receive free satellite images in order to test the new tool (app). Actually, the remote sensing technology does not need a patent, however the license agreement with KSAT can be signed. After the first year, IQ will buy the satellite images from KSAT and, thereby, will pay for the technology. Therefore the possibility of infringement of IP rights is close to non-existent.

The main type of IPR protection, which is available for the company, is brand registration. The existing working name of the company is “EyesQ” AS and the service and application name is "Inquire the quality" or IQ, which are unique accordingly to Norwegian rules.

2.1.4. KSAT AS AN IDEA PROVIDER AND TEAM. COOPERATION AND COLLABORATION

Kongsberg Satellite Services AS (KSAT), which has been working on the remote sensing market since 2002 (KSAT 2016), is the idea provider. In order to develop the final product, KSAT provides to IQ team the technical support and the satellite images. Nowadays, the KSAT’s main activity is the maritime monitoring and surveillance services using the data from the several radar and optical sources. Indeed, the remote sensing tool opens the new opportunities for the development a cost-effective system for assessing and monitoring the conditions, yield and perfect harvesting time for crops, inter alia rapeseed. For this purpose, the satellites can provide the high-resolution images of rapeseed fields within the particular period of time.

From the beginning of the project and until 2018 the management team will be represented by the Board and owners. The Board members are Fredrik Landmark (the Board Chairman), who has educational and working background in business development, sales and marketing; Lene Wium who works as Senior Business Developer in the incubation team; Torbjorn Eltoft, professor in Physics and Technology, has experience in earth observation, signal and image processing and remote sensing. The owners are Anastasia Leonenko (49 %) brings a wealth of the project development, management, research development, network establishment nationally and internationally, PR and strategy, funding; Maryna Vakulenko (51 %) has good knowledge and skills in the start up establishment; strategic thinking; financial analysis; marketing strategy; staff management; risk management and negotiations. The position of CFO will be appointed by KSAT in order to reduce the project costs. In addition, the Center of integrated remote sensing and forecasting for the Arctic operations (CIRFA) will provide for free the working place and Norinnova will help to attract funds during the pre-pilot and pilot projects stage.

2.1.5. NEXT STEP

Accordingly to Jolly's overlapping stage-model in which the current approach to early-stage business development (Alänge and Lundqvist 2010), the IQ service is now in the process of transition from Imagining to Mobilizing. The Incubating stage will start after the company establishment and signing of a partnership agreement with rapeseed oil producer in order to have a *pre-pilot project*. During the pre-pilot project we expect to determine accuracy of the provided data, timeline and identify the most powerful parameters. At the same time the pilot *website* and *app* should be created as the next Mobilizing stage in order to prepare to the Demonstrating stage. The pre-pilot along with pilot project will take one year and after that the IQ service well be ready for the Demonstrating stage.

2.2. CUSTOMER'S UTILITY

With an eye to customer's utility, we need to answer three main questions in order to identifying and prioritizing situations of use, such as: " How can the remote sensing technology be employed in the biodiesel sector?" "Where we should start?" and "Who can apply the idea and put into use?" The answers on these questions help to identify the social and business utilities and find out the limitations. This information will give the reason to the investors to put the money in IQ (Alänge and Lundqvist 2010).

2.2.1. IDENTIFYING AND PRIORITIZING SITUATION OF USE

HOW TO USE THE REMOTE SENSING TECHNOLOGY IN THE BIODIESEL SECTOR:

The biodiesel and rapeseed oil producers define the area of their interests (particular rapeseed fields). Then they determine which data they need for the accurately prediction of the production capacity, transportation and storage needs. In other words, they request the data about yield, quality, timeline, volume etc., of the raw material (rapeseed) in pointed area. Then the required data will be extracted from the satellite images, processed and analyzed. Afterwards, the required data will be delivered to the customer. The information will be delivered via app.

WHERE WE SHOULD START:

We have to start from the pre-pilot along with pilot project. We are planning to begin the pre-pilot on **15th June 2016** and finish on **15th December 2016**. The project will be started from the registration of the start up company and agreements conclusion with the partners (KSAT AS, CIRFA UiT and biodiesel plants from Lithuania). At the same time we are planning to start collaboration with biodiesel plants. In July the application (app) for the IQ service will be ordered in Ukraine. The manufacturing will take 5 months. At the end of the harvesting period we are going to evaluate the most important indicators for the all biodiesel plants. The interim results will be presented on the 9th Biofuels International Conference in Ghent, Belgium in **22th September 2016.** After the presentation in October 2016, we are determining specific indicators for each biodiesel plant, which take part in the pre-pilot project. The general feedback will be received from the partners until the end of the November 2016.

The pilot project will start **9th January 2017** with two biodiesel plants. They will be offered to test and evaluate the app and the website and give a feedback. The improvements will be employed accordingly to the feedback. The research area will be chosen and uploaded to the application during the March-April 2017. The test of the tool will take place within May 2017.

WHO CAN APPLY THE IDEA AND PUT INTO USE:

This idea will be tested in Lithuania by three biodiesel plants, namely: Pasvalio agrochemija UAB, Rapsoila UAB and Kurana UAB. These companies have been chosen because of their production capacity (more then 100 000 tonnes per year), needs in the high quality raw material and area, where from they buy the feedstock (Europe). Hence, if the tested idea provides the positive result, these plants can become the first three customers that was mentioned in the Business plan.

2.2.2. SOCIETAL UTILITIES FOR PRIORITIZED USE

Nowadays, the biodiesel producers are heavily subsidized by governments, which help to cover the raw material costs, logistic costs, production costs and costs arising from ecological issues. As was mentioned before, the raw material costs constitute 70-95% of the production costs. The IQ project aims to identify why some biodiesel producers spend more than 70% on the raw material and provide the service, which will help to decrease the raw material costs up to 70 %. This will increase the competitiveness of the biodiesel producers. In turn, the demand for the biodiesel will raise and the usage of the diesel will go down. As a result, the CO_2 emission will go down that eventually corresponds to the global environmental policy. The IQ service opens the new opportunities in order to develop a cost-effective system for assessing and monitoring the conditions, yield and perfect harvesting time for crops.

2.2.3. BUSINESS UTILITIES

The medium and big size biodiesel plants are the main buyers and users of the IQ service. The most important agricultural parameters that biodiesel plants need to know are *the oil content* and *yield* from the hectare. If these data can be received in advance until July-August, the biodiesel plans can choose the best quality regions and conclude contracts with the raw material producers from those regions. However, the transportation, storage and some other technological stages represent the subsequent stages of the biodiesel logistic chain, where IQ service can be applied as well.

2.2.4. CUSTOMER UTILITIES FOR PRIORITIZED USE

Different agricultural technologies and the other inputs can affect the quality of the raw material and, consequently, *the energy efficiency* of the biofuel production. This parameter, in

turn, influences the production costs (Firrisa 2011). Hence, we can make an assumption that if the information about the quality and the yield of the raw material can be received before the rapeseed will be delivered on the storage, the biodiesel plant can have an opportunity to choose the areas with the better raw material characteristics. Therefore, the input costs will be lower, and the quality and quantity of the rapeseed oil, as the output, will increase. Ultimately, it will positively affect the production costs and profit. For this purpose, the biodiesel plant needs the monitoring system, which can provide necessary data and ensure the biodiesel producer an instant access to this information. Likewise, this data can definitely impact the speed and quality of the decision-making that concerns the raw material supply agreements. Thereby, the IQ can provide this service in order to lead the resource management of the biodiesel plants to the next level.

2.2.5. LIMITATIONS

The service allows receiving the information in the near real time. It means that some time will be used to analyze the data and provide it to customer. The unfavorable weather conditions can also be a challenge, however some new satellite technologies help to solve this problem. The service is useful just during the vegetation and harvesting period. IQ service can be employed outside EU area that allows using it all year around. High price on the remote sensing technology strongly affects the market and makes IQ service available just for the big or medium size customers (Mulla 2013). The IQ service should be worked out and universalized during the pilot project in order to be independent from individual features of the customer. The IQ has some limitations that relate to human factors. The accuracy of the information from the satellite images requires upscale expert in reading and interpreting the data from the satellite (Wendimu 2016). The other limitation for the IQ is the access to the satellite data.

2.3. THE INNOVATIVENESS OF THE IQ SERVICE AND POSITION OF THE REMOTE SENSING TECHNOLOGY ON THE INNOVATION MAP

The innovativeness of the remote sensing technology in the biofuel industry was described in the previous section from the both marketing and technological perspectives. In this regard important to identify the uniqueness of the IQ innovative service as a particular innovation type. For this purpose the remote sensing technology is parsed in this section to identify if it belongs to *radical*, really-new, *incremental* and discontinuous to determine the type of the

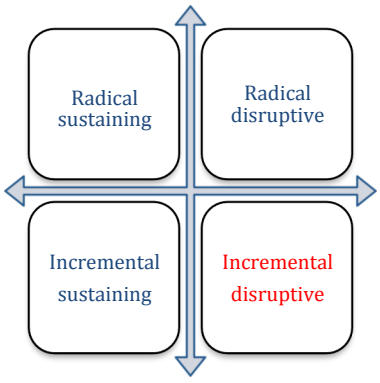
innovation (Garcia and Calantone 2002). Respectively, the remote sensing images when it comes to the reduction of the production costs can be defined as *really-new* or *incremental*. This technology is positioned as an *incremental* due to the fact that this is existing technology that can be applied on the totally new market where it will be *really-new*. In this case, the typology distinguishes between 'high', 'moderate', and 'low' innovativeness is more preferable. In this regard, the IQ service belongs to the *moderately innovative products* (Kleinschmidt and Cooper 1991), which is not new for the remote sensing market but will be the new solution for the biodiesel market. From this prospective, it is important to define the degree of newness and what is actually new.

The creation of the innovation implies not only the innovative product development. This concept includes engineering, marketing, management and economical aspects that make the idea of the innovation much broader. In this regard, Freemaii (1991) has defined *innovation* as "an iterative process initiated by the perception of a new market and/or new service opportunity for a technology-based invention, which leads to development, production, and marketing tasks striving for the commercial success of the invention". At that point, there are some parameters that indicate the level of the innovation and identify the "newness" of the product to the world (Song and Montoya‐Weiss 1998), industry (O'Connor 1998), market (Kleinschmidt and Cooper 1991) or consumer (Atuahene‐Gima 1995).

The identification of the innovation often comes to the following issues, such as: to whom it is innovative and from whose perspective it is innovative. That is why, it is important to identify distinction between macro and micro perspectives. From the *macroperspective*, the remote sensing technology is the innovation that is not new to the **world** but it is absolutely new for the biofuel **market** and the new instrument for the production costs reduction and effective resource management in the biofuel **industry** (Atuahene-Gima 1995). In view of the *microperspective*, the remote sensing technology is absolutely new to the **customer** (More 1982). In this regard, the IQ marketing, distribution chains and sales approach play the crucial role in the determining of the innovativeness and depend on the IQ capabilities and competencies (Garcia and Calantone 2002). Consequently, the remote sensing technology can be defined with varying degrees of innovativeness for the variety of the companies depending on the industry. Thus, the following paragraph outlines what kind of technology we work with to determine activities for the commercialization of the IQ service on the biofuel market.

The research literature is defined the disruptive and sustaining innovative technologies. These categories are totally different by nature and demand different approaches in order to commercialization process. In the remote sensing case, the technology can be defined as disruptive because IQ service is not aimed to be launched on the existing market but will be created in order to be introduced on the new market. As articulated by Kassicieh, Walsh et al. (2002), the companies that pursue *disruptive* technologies must be more creative in the marketing irrespective of the source of innovation, size or financial performance. In this case, it is important to focus on the new market and be ready for the long commercialization process with the low cash flow potential in the very beginning. Indeed, the IQ service should be developed through supporting infrastructure (TC: it might be the spin-off or new department from KSAT or start up company) to realize new service on the biofuel industry. On the other hand, the KSAT is interested in distribution channels and market growth that is closer to the characteristic of the firms working on sustaining technologies. For this purpose, the *innovation map* (See figure 2 below) should be used as a visual aid to clarify the position of the remote sensing images on the biofuel market. The challenges and the opportunities of such position of the remote sensing technology and possible market affect are presented on the next section.

Figure 2. The innovation map of the remote sensing technology on the biofuel market



2.4. THE IMPACT OF THE REMOTE SENSING TECHNOLOGY'S POSITION ON CHALLENGES AND OPPORTUNITIES AT THE BIOFUEL MARKET

The position of the IQ service, which is based on the remote sensing technology, on the innovation map was defined as "Incremental, disruptive" (See Figure 2 above). The more precise position is reflected on the Figure 3 below.

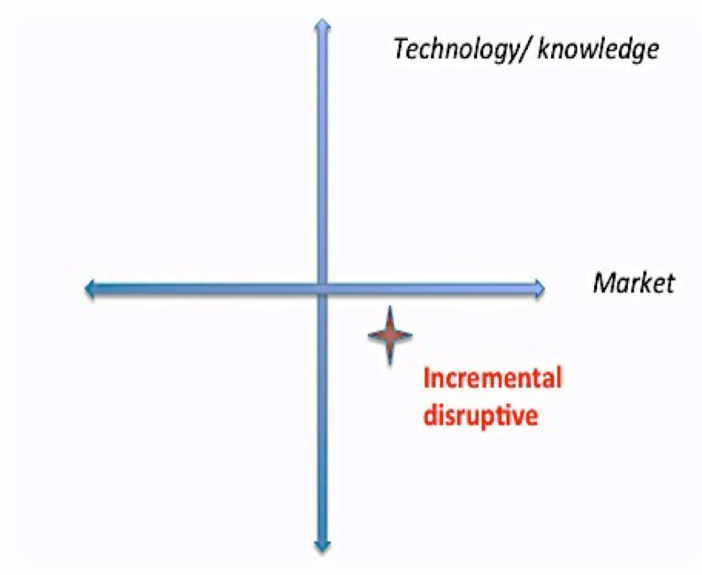


Figure 3. The precise position of the remote sensing technology on the innovation map.

This position is valid for the current time and can be changed in the future. The reason of choosing this position lies in the characteristic of the product. As was mentioned before, the remote sensing images is disruptive for the biofuel market but nowadays this is just an assumption that was made. Pointer can move along the horizontal axis in the both directions but within "disruptive area" during the pre-pilot and pilot projects. The same situation is with "incremental" position. The remote sensing technology is employed today in the other industries but may become a completely new for the biofuel market. Proceeding from this, the challenges and the opportunities in the market for the remote sensing technology are outlined in the next two paragraphs.

There are three different elements in relation to the entrepreneurial *opportunities* such as: opportunity recognition, opportunity identification, and opportunity creation (Henry, Foss et al. 2015) Indeed, it is a challenge to understand that some idea can be commercialized, particularly if resources are limited and the market does not exist. From that prospective, entrepreneur should apply creativity in terms of economic value. In the remote sensing case is important to identify the valuable proposition that IQ service can offer to the customers in order to provide the effective resource management tool for the biodiesel sector. When it comes to the opportunity creation, the customer's needs or problems come on the first place. Actually, this is a good opportunity to *create the new niche* in the market and thereby *offer the new solution* for the industry. Development of the new market and the unique offer will allow not only *increase the profit* in the future but also take a *leading position* in the market.

Notwithstanding the opportunities that the IQ service has or will create, the challenges are clearer and a lot of them exist today. The first challenge is to *identify the customer's needs*. For this purpose, the strategy of the market need's and problem's identification was discussed with the KSAT representatives. It was agreed to initiate the pre-pilot along with pilot project involving biodiesel and rapeseed oil producers in the Europe. It will allow to learn from the potential customers about their existing and latent needs to be able to create superior customer value (Slater and Olson 2002). The second issue is the *network creation* that will help to build communicative and distribution channels and get the excess to the customers and market information. The management of the network relations in the commercialization can be also crucial for accessing, mobilizing and organizing resources (Aarikka-Stenroos and Sandberg 2012). The third issue is the *lock-in problem* that may take place in case if the actors within the biofuel industry are used to cooperate with each other only within the certain network. In that case, IQ has to build their commercialization network from scratch. On the other hand, the IQ should not aim to build a multi-industry network. Indeed, it would be more effective to focus on the narrow market niche and able to avoid failure in case of the wrong selected market. The challenges that were described in this section are important to take into consideration when it comes to the pilot project and the early stage of the product commercialization.

2.5. CONCLUSION

The aim of the innovation study was to determine the remote sensing technology position in the market in order to provide the effective resource management tool for the biodiesel sector. For this purpose, the remote sensing technology was placed on the innovation map that will allow coming up with the marketing solutions during the commercialization process. The position was defined as "Incremental, disruptive" on the innovation map that characterize the IQ service, which based on the remote sensing technology as the new solution for the new market. However, the remote sensing technology is not actually new and has been using in the other industries. For this reason, we use the Kleinschmidt and Cooper (1991) typology, that characterise the remote sensing technology as moderately innovative product which determines the degree of the newness and what is actually new. Therefore, we have answered the questions: "to whom it is innovative" and "from whose perspective it is innovative" on the micro- and macroeconomic levels. This leads to understanding the precise position of the remote sensing technology on the biodiesel market, which, in turn, is

necessary for selecting the marketing strategy. In this regard, our findings should be supported into a wider range of market analysis by research of the challenges and opportunities for the application of the remote sensing images in the biofuel market. Consequently, future research should focus on the product that can be the new solution for the potential customer, which is the key research question of this Master thesis.

3. MARKET STUDY

This thesis aims to investigate the market opportunities for the new technological solution for the biodiesel sector by employing remote sensing images in order to provide more accurate data over a shorter period of time for the biodiesel producers. In this regard, the German biodiesel market as the largest European biodiesel market has been investigated. The idea provider is *Kongsberg Satellite Services (KSAT)*, which is involved in the development the new service that has a working name *"Inquire the quality" or IQ*. KSAT is the multi-mission provider of the commercial satellite imagery and data. Using the global ground network the updated satellite imagery can be delivered to customers within fifteen minutes in the arctic region and, normally, within one hour globally. KSAT supplements imagery with data from medium- and high-resolution images, which analysts process around-the-clock. The biodiesel market is the totally new market for the company, however it is potentially a very promising area.

The study provides market analysis, customer analysis, competitor analysis, and environmental analysis and offers the market strategy that can be employed with the purpose of introducing the new service to the market. This market study basically focuses on the potential customers needs, problems, competitors, future trends and eventual benefits that buyers can get from the applying of the IQ service. The market study represents description of the main segments of the biodiesel sector. One of the primary part is an agricultural commodities overview that gives the opportunity to evaluate potential raw material capacity, which is one of the basic parameter in the IQ service, for the domestic market. Biodiesel production, consumption and turnover, trade and price represent the market size and allow us to estimate the market volume, customers' needs along with potential of the market players to take advantage of the new service. The market players and supplying chain are considered from the standpoint of the potential customer and specified in the customer analysis section, which is focused on the customers' segmentation. The main trends, issues, needs and uncertainties that influence the market plus the players are presented at the end of the marketing analysis. The marketing strategy is divided on several sectors, such as: SWOT-analysis and Marketing mix strategy. SWOT- analysis has been chosen as a strategic planning tool, which satisfies the requirements at the early stage of the service development. Marketing mix strategy (4Ps) helps to determine the position of the IQ in the market more

accurately. Thereby, comprehensive assessment of the market makes possible to determine the feasibility of the further launching of the IQ service to the market.

3.1. MARKET ANALYSIS

The market analysis is a considerable part of the business strategy, especially for a new product. Market analysis is carried out to consider the rate and unpredictability of changes that occur in the market in order to decrease the risks that influence profitability and the costs rate/margin. Market analysis helps in strategy formulation and strategy content (Slater and Olson 2002). The market analysis of the German biodiesel market, the largest in European biodiesel market, which provides the general overview about the basic concepts of the market, market structure, main market players, price, potential customers, and trade figures. The structure of the market characterizes the biodiesel market by the production, consumption, turnover, market segments, size, market growth, and commodities positioning. Commodities positioning is a very significant indicator, which is indicated by export/import figures. For this case, it is important to know if Germany can cultivate enough raw materials for the biodiesel production or has to import it from abroad. Actually, the awareness about the sources of the raw materials allows us to assess the necessity to use satellite data in a particular region.

3.1.1 THE OVERVIEW OF THE AGRICULTURAL COMMODITIES MARKET

During the last 15 years, the biodiesel production in EU and, particularly, in Germany has been steadily growing. It means that there has been growing demand for energy. This was caused by socioeconomic and environmental factors, which are, in turn, determined the choice of *rapeseed* as a major source of the raw materials for the biodiesel sector in Germany. The rape, turnip rape, spring rape, winter rape, and winter and spring bird rape have occupied 2612,4 hectares in 2012. It constitutes 56,77 % of the total area occupied by crops (Patrick 2015) or 4655,91 hectares in Germany. Actually, Germany, France, and Poland were the main rapeseed producers in EU in 2012 and were responsible for 54% of the EU's yield. When it comes to the global market, the EU was the biggest world producer in 2012 with the yield equals 22,4 million tonnes that constitutes 34% of the world's rapeseed production. The rapeseed production has been almost doubled between 2002 and 2012, mainly due to expansion in cultivated areas (Queirós, Malça et al. 2015).

3.1.2. BIODIESEL PRODUCTION, CONSUMPTION AND TURNOVER. THE MARKET SIZE AND GROWTH

In 2015, Germany was one of the largest biodiesel producer within EU, with 3,180 million liters per year, (See Table 1 below) which constitutes 30,33% of the total EU biodiesel production.

*Table 1: Biodiesel production in Germany 2009-2015, million liters (USDA Foreign Agricultural Service, 2015). *- forecast value*

Year	2009	2010	2011	2012	2013	2014	2015
Biodiesel, Millions liters	2,598	3,181	3,408	2,954	3,067	3,408	3,180*

The biodiesel market turnover in Germany in 2010 and 2011 was 1,920 million EUR and 2,460 million EUR respectively per current currency exchange rate. In this regard, despite the decreasing production in the recent time, the market was either stable or rising between 2010 and 2014.

The biodiesel consumption is driven by environmental government policy and by tax incentives (USDA Foreign Agricultural Service, 2015). After the years of rapid growth of demand, the biodiesel consumption in Germany peaked in 2010 and then had a tendency to declining (See Table 2 below).

*Table 2: Biodiesel consumption in Germany 2009-2015, million liters (USDA Foreign Agricultural Service, 2015). *- forecast value*

Year	2009	2010	2011	2012	2013	2014	2015
Biodiesel, Millions liters	2,859	2,933	2,756	2,816	2,513	2,606	2,440*

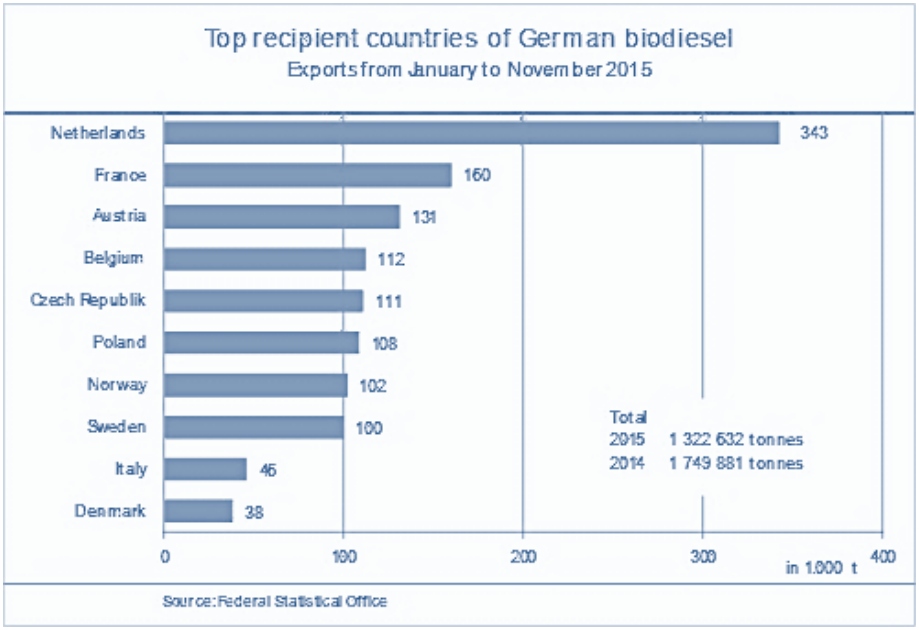
Hence, Germany produces more than it consumes. Therefore, it means that the rest of the biodiesel (1,808 millions liters) has been exported.

3.1.3. TRADE OF BIODIESEL IN GERMANY: IMPORT AND EXPORT VOLUME

According to figures from the German Federal Statistical Office (GFSO), Germany has exported in 2014 approximately 506,7 million gallons. This is almost 6% more compare to 2013 when 480 million gallons of biodiesel has been exported. *The biodiesel export* has constituted 364.4 million gallons (1 215 000 tonnes) in 2012, that was nearly 32% less then in 2013. The 2011-12 showed nearly 10% decline that was the only deviation from the growing export since 2009 (Kotrba 2015).

However, accordingly to the GFSO foreign trade figures, the biodiesel export in Germany went down during the first 11 months in 2015, which is almost on the 25% from same period in 2014. In accordance with data from Agrarmarkt Informations-Gesellschaft mbH (AMI), such a rapid decline in biodiesel exports was caused by falling demand from the Netherlands, France and Poland. Taking into consideration that almost 90 % of the exports went to EU member states, such a massive decline of the biodiesel delivery has influenced the export in 2015 significantly.

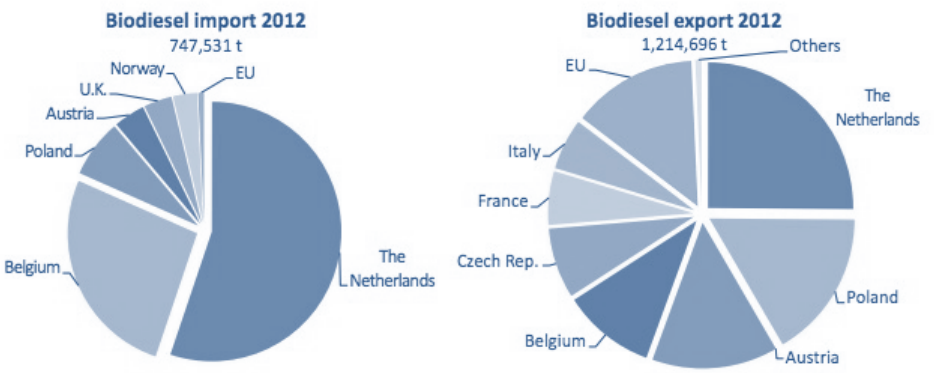
Figure 4: Biodiesel export from Germany 2015 (Jan-Nov), tonnes (Lane, 2016).



Netherlands, Poland and France have declined biodiesel import from Germany on 42%, 38% and 26% respectively. However, German biodiesel export to the Czech Republic has risen almost 80 % (See Figure 4 above). The same trend is relevant for Sweden (Lane, 2016).

Germany had a positive biodiesel trade balance due to the fact that 748 000 tonnes of the biodiesel have been imported in 2012, and 1 215 000 tons have been exported. (Licht's, 2013). More than half of the general export volume of the biodiesel (55 %) has been exported to the Netherlands. Furthermore, the biggest share of the traded biodiesel is going through the Amsterdam-Rotterdam-Antwerp port. Belgium takes the second place behind the Netherlands. The Netherlands, Poland, Austria and Belgium are the main receiving countries of the exporting flows. Summarizing the above, it should be noted that the biodiesel trade is used to be primarily with neighboring countries (Figure 5).

Figure 5. Trade of biodiesel: import and export volumes, Germany in 2012 (F.O.Licht's, 2013)

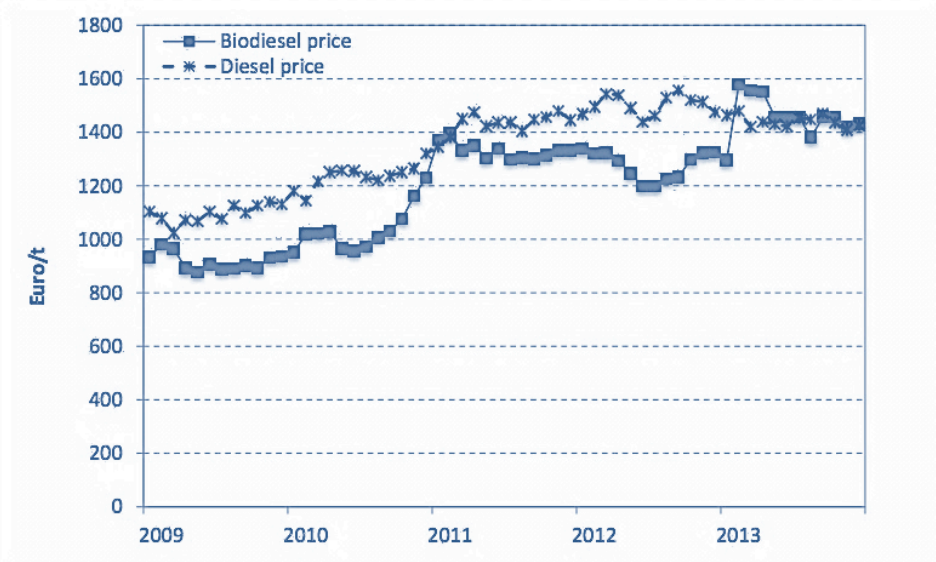


3.1.4. PRICE

The price on the biodiesel depends on many different factors at the micro and macro levels. The macro level is presented by several major factors. First of all, the tax credit (exemption) is the driving force of the biodiesel prices and the price behavior. The second factor is the price policy of the leading country in the biodiesel sector that determines the world biodiesel price. EU is the price leader in the world biodiesel market, hence, the EU mandate impacts the world biodiesel price (Rajcaniova, Drabik et al. 2011). Furthermore, the price is under the influence of the crude oil price (Charles, Gerasimchuk et al. 2013) and the euro–dollar exchange rates. The micro level is substantially represented by the government subsidies to the biodiesel sector and costs, such as: raw material costs, logistic costs, production costs and costs arising from ecological issues (Abdelradi and Serra 2015). The described theory completely corresponds to the situation on the biodiesel market in Germany that is described in the next paragraph.

The wholesale prices for biodiesel market that was based on the rapeseed were stable in 2009-2010 in Germany. The price on biodiesel peaked in 2013 with the average price of 1450 €/t (Figure 6) and shown the 50 % compared to 2010.

Figure 6. Biodiesel and diesel price development in Germany from 2009 to 2013 (biodiesel: wholesale price, excl. VAT diesel: consumer price, excl. VAT) (UFOP, 2014) (MWV, 2014)



Then prices went up sharply influenced by the higher price for the feedstock rapeseed and rapeseed oil (Thrän, Hennig et al. 2012). This dynamic is caused by the nature of Economics. However, one of the biggest barriers for the biodiesel sector's development is its direct connection to the diesel price. Also, the economic challenges for biodiesel sector are created by the government mandates and taxes (Patrick 2015). Taking into consideration that the global crop supplies (including rapeseed) are abundant and the crude oil prices remain at multi-year lows, it is possible to assume that the biodiesel feedstock prices have limited upside potential in the 2016 year. In its turn, the decline of the demand on the rapeseed is induced by that fact that the crude oil prices remain far below biodiesel prices. Hence, the fuel blenders will use exactly the necessary rate that is required to meet government mandates. In addition, the difference between the rapeseed oil price and rapeseed-based biodiesel price tends to narrowing down that will decrease the utilization rates among biodiesel producers (ARGUS, 2016). All those factors strongly affect the biodiesel sector players and form the price in the future. Nevertheless, the market situation can be rapidly changed under the influence of the growing oil price, application of the new cheap raw material for the biodiesel production, introduction of innovative technology in the market and changing government policies.

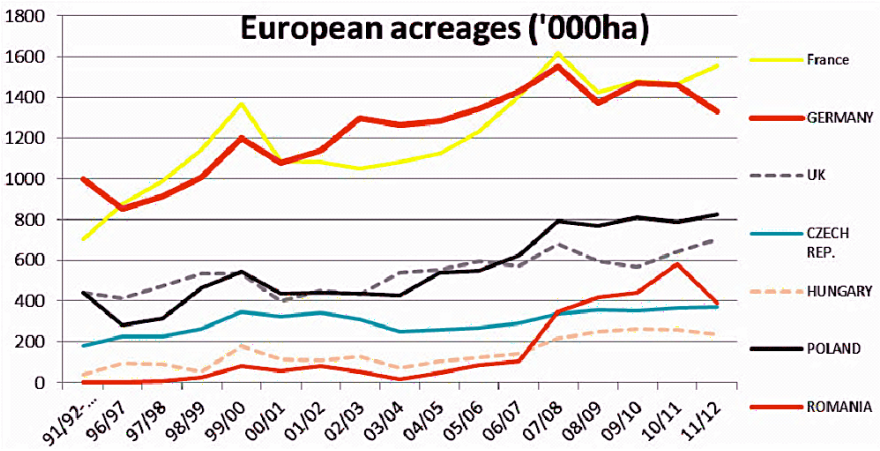
3.1.5. MARKET PLAYERS AND SUPPLYING CHAIN

The biodiesel market strongly depends on the development process of the biodiesel itself. The development process is consists of the seven major operations that is presented in the Figure 7 below.

Figure 7. The 7 major steps of the biodiesel development process (Sheehan, Camobreco et al. 2000)

The first step is one of the most important. Production of the rapeseed essentially affects the amount, quality, and price of biodiesel. Rapeseeds are harvested in all continents of the world. 57% of all oilseeds originates in the North American continent, 23% in Asia, and about 9% in Europe. During the last 25 years the rapeseed crushing has been rising dramatically and during this time the major players appeared in the market. Europe is one of the biggest player in this market, followed by Canada and China (Carré and Pouzet 2014). The rapeseed annual harvest in the EU was a little over 22 million tonnes (The Western Producer, 2016). France and Germany are the leaders of the biodiesel market in the Europe. Actually, France and Germany are cultivating approximately the same surface areas (in the range 1,4–1,6 million hectares) and follow the similar trends. For example, in 2011 and 2012, France and Germany were within 1,56/1,33 and 1,61/1,31 million hectares, respectively (See Figure 8). However, that gap decreased in the 2013 till 1,44 and 1,46 million hectares respectively.

Figure 8. European oilseed rape (OSR) acreage (×1000 hectares) in the major European countries (Source: Oil World, 2012)



The consumption of biodiesel in Europe has experienced an impressive growth from year 2007 until 2012 with 57%. However, in 2013 and later this indicator is volatile. Nowadays, around 200 biodiesel plants produce the biodiesel in EU. Their production capacity constitutes over 8,5 million tonnes. Actually, according to the US Energy Information Administration, the European biodiesel constituted 43% of the world's production in 2011. Despite the long-term growth of the industry, the consumption and production of the biodiesel has shown a negative dynamic in the recent years. The economic crisis, the fuel price fluctuation followed by sharp decline, exchange rate volatility, massive imports and dumping practices from Argentina and Indonesia have been influenced the share of the biodiesel, which should be blend with traditional fuels (EBIA, 2012). In this regard, the biodiesel market players need to have more accurate information about the rapeseed and each of them can be considered as one of potential customer for the IQ service.

3.2. CUSTOMER ANALYSIS: POTENTIAL CUSTOMERS SEGMENTATION, THEIR MOTIVATION AND NEEDS

The customer analysis aims to identify current and potential competitors in order to make customers segmentation, which allows investigating customers' behavior and evaluating their needs (Ha 2007). For these purposes three groups of the potential customers have been analyzed. The criteria for the *Rapeseed producers* were based on the common needs as the farmers usually have, such as: measuring key land parameters, precise agriculture trend, biomass feedstock evaluation and cropland mapping. The *Biodiesel producers or biodiesel*

plants were considered through the logistic and organizational criteria. Accordingly to the interview with Brock Adam McCarty from Apollo Mapping and Rolandas Gabstas CEO of Pasvalio agrochemija UAB (biodiesel plant in Lithuania) this group has a basic need in information during the growing and harvesting period to be able to evaluate the quality of the raw material, plant, transport and storage capacity (See Table 5 and Table 6 in Appendix). The Biodiesel producers have been selected as a target group for the business plan and for the future pre-pilot along with pilot project. *Consulting companies and Stock exchange players* are the third market segment that has common needs in accurate and updated information in order to make decisions for the future. The timing and "to obtain data the first" are criteria, which is crucial for this market, accordingly to interview with Brock Adam McCarty from Apollo Mapping (See Table 5 in Appendix). The investigation of this segment is a very time consuming process and can be separated into its own project in the future. The following sections provide analysis of the biodiesel market participants, their unmet needs, and ideas about satellite images application as an innovative solution. The technology has found its use in agriculture and logistic but still quite innovative for the other market segments.

3.2.2. RAPESEED PRODUCERS: CULTIVATION OF THE RAPESEED

The satellite technologies and information that can be extracted from the satellite images can assist to measure the key land parameters like soil moisture and vegetation biomass (Egido, Caparrini et al. 2012) that is crucial for the effective resource management and risk hedging. Furthermore, the information, which is received from the satellite images, opens a wide opportunity to consolidate data and present a complete picture. For example, the collection and analysis of the massive datasets from the certain area allows finding interrelation between energy, water and agricultural production, which, in turn, influence the costs and profit. However, remote sensing technologies are still very rarely used for these purposes (Sanders and Masri 2016). The opportunities and solutions for the different issues that occur during the cultivation of the rapeseed are displayed in the Table 3 below.

Table 3. Potential remote sensing applications for resource management (Sanders and Masri 2016).

Technology	Application
Multiple	Remote sensing for precision agriculture
Satellite	Agricultural tractor guidance via satellite
Satellite	Agricultural monitoring with satellite data

Satellite	Satellite remote sensing of diseased crops
UAVs	Crop area estimation
UAVs	UAVs for precision agriculture applications
USV/UUV/R	Open software platforms for robots in precision agriculture
Satellite	Assessing drought probability/impacts on crop production
Satellite	Advances in image-based remote sensing
Multiple	Monitoring bioenergy feedstock production systems

All these applications influence the new trend in agriculture, namely *precise agriculture*. Agrawal and Parmar (2016) suggested that "*Precise agriculture aims to collect and store data about slope, aspect, yield, wet and nutrients with the help of GPS, used optical and RADARSAT-2 satellite images for corn monitoring and crop yield, monitor crop condition for obtaining better estimations of crop yield and obtain polarization signatures from RADARSAT-2 data for corn and relate these to Leaf Area Index (LAI) and photosynthetic active radiation (PAR) crop parameters and vegetation indexes, to establish indicators of crop condition and produce estimates for crop yield*". This innovative approach is designed to increase the biomass feedstock production and productivity of the rapeseed, estimate biomass and yield, monitor vegetation vigor and drought stress of the crop, assess the life cycle events and factors that make impact on the crop, make the cropland mapping and changes during the certain period of time (Atzberger 2013). Hence, if farmers spend resources on those areas where it is necessary and to a lesser extent, it will decrease costs and increase profit due to the higher yield and better quality of rapeseed.

3.2.3. BIODIESEL PRODUCTION AND SUPPORTING INFRASTRUCTURE: BIODIESEL PLANT, TRANSPORTATION AND STORAGE

The rapeseed producers represent just the first stage in the logistic chain of the biodiesel production and can also be referred to the agriculture. Biodiesel plants, transportation, storage and some other technological stages represent the second and subsequent stages of the biodiesel logistic chain, where satellite service can be applied. First of all, the delivery of the raw materials, which are produced over the large geographical areas, is associated with some difficulties, such as: limited availability window and voluminous materials. Generally, the biodiesel plants and intermediates store the significant amount of seeds during the long period of time. One of the issues on this stage is the weather condition that determines moisture content (mc) of the seeds and stipulates if there is a need for drying. The other

challenge is transportation. For example, the raw material may be transported in several different forms. It depends on the biomass, raw material quantity, customer's location and distance to be covered. If the local suppliers provide the raw material, the main transport is the road transport because of the short distances. The railway and ships are the best solution for the plants that manufacture annually the several hundred thousands or million tonnes of rapeseed. However, the railway implies a more complicated system, which is less efficient than the road transport (Sambra, Sørensen et al. 2008). Thus, the companies that operate within the areas described above tend to have a low input of the resources and receive the maximum output. It means that they try to decrease the costs and increase the profit by time, labor and finance optimization. Consequently, the whole system operates in time and space coordinates. Therefore, the initial information in near-real time, the precise estimation of the logistics costs and the global view on the production processes are necessary.

3.2.4. CONSULTING COMPANIES AND STOCK EXCHANGE PLAYERS

The consulting companies and the stock exchange players are widely represented in the biodiesel sector. These companies predict and determine the future market trends. Their work is based on the development of the appropriate responses in the business environment, identification of the strategic priorities and providing the clear view of the competitive positioning. For these purposes, they can offer several services such as:

- Strategic, Financial, and Operational models, which aim to increase efficiency
- Valuation models for assessing assets and portfolios of assets
- Market models that assist forecasting the market changes (supply/demand, pricing) and determine key input factors
- Competitive landscape models that identify changes in the external environment referring to competitive landscape
- Macroeconomic models to be able to predict future trends

In order to provide a high quality service and the effective functioning of the exchange mechanism, these actors need to obtain the most recent and reliable information. Generally, their recommendations are based on data, analysis and scenarios that result in working hypothesis by means of analytical approach along with methodologies (Hartenergy, 2016).

In this regard, introduction of the new technical tools like a global positioning system (GPS), geographical information system (GIS) and remote sensing allow to provide more accurate estimation the products prices, worldwide trading and the other quantitative and qualitative indicators (Agrawal and Parmar 2016).

3.3. COMPETITORS' ANALYSIS

The competitors' analysis aims to identify of the potential and existing competitors, investigation their intentions and capabilities in order to develop an effective business strategy (Brock 1984). This analysis consists of two parts, such as: competitors' identification and analysis of the competitors' intentions, capabilities, and weaknesses.

3.3.2. COMPETITORS IDENTIFICATION

There are three potential competitors have been chosen for the analysis: DigitalGlobe (USA), BlackBridge (Berlin, Germany) and Apollo Mapping (Boulder, Colorado, USA). These companies were selected after the interview with Apollo Mapping based on their size, market position, sale chain, experience in agriculture, and potential to represent the same as IQ service in the market. In addition, all these companies were chosen because they meet the four most important criteria for the satellite service market, which are described further.

3.3.3. COMPETITORS CAPABILITIES AND WEAKNESSES

The most important competitor advantages are the high-resolution images (pixel size: from 1 meter to 30 centimeters for the commercial purposes), accuracy (around 3 meters), delivery of the data in the "near real" time or "real time" and analysis. The comparison of the strength and weaknesses of the companies, including KSAT, you can find in the Table 4 below.

Table 4. The comparison of the strength and weaknesses of the companies, including KSAT, which is a technical representative for the IQ service

	KSAT	Digital Globe	Black Bridge	Apollo Mapping
High resolution	+	+	+	+
Accuracy	+	+	+	+
Time	+	+	+	+

Analysis	+	+	+	+
Experience with the biofuel industry	-	-	-	+
Experience with agriculture	-	+	+	+
Broad sale chain	+	+	+	+
Global company	+	+	+	+

DigitalGlobe is the company that has five branches in USA, one in Europe (London) and two in Asia, which can offer the wide range of different remote sensing services. The *DigitalGlobe* provides satellite service for the agriculture. The company has nine members in the board of directors and fourteen in the management team. DigitalGlobe positions themself as a leading global provider of high-resolution earth-imagery products. DigitalGlobe owns and operates the high-resolution commercial earth imaging satellites like WorldView-1, GeoEye-1, WorldView-2, and WorldView-3. These satellites are capable of collecting over one billion square kilometers of quality imagery per year. DigitalGlobe has the following advantages: high resolution, accuracy, speed and analytics. WorldView3 satellite has a very high spatial resolution (0.3 meter), which primarily was designed to estimate the crop moisture, soil residue, moisture content, and organic matter. The location-based systems provide high accuracy images (less than 3 meters). For instance, High Performance Extraction (HPX) is defined to be a very accurate classification of objects and/or estimation of object states from a single image or sequences of images. The HPX is often necessary for accurate and reliable "active management" (DigitalGlobe 2014). The company can provide not only images but also analysis of the data from them. DigitalGlobe has been founded under the name WorldView Imaging Corporation in 1992 and has almost twenty years experience in the market (DigitalGlobe 2016).

BlackBridge is focused on providing the end solutions for the clients. This includes satellite operations, ground station services, data center and geocloud solutions. The company has over 100 partners and creates the value of their services providing complementary products to the satellite images. BlackBridge has an international team that includes more than 130 employees, which have backgrounds in remote sensing, space systems engineering, forestry, geography, geology, agriculture, software development, and the other related fields (BlackBridge 2016). BlackBridge has a very broad chain of sales partners, who are spread over the world and can provide services in all continents. One of their strong side is the sale

partner in Germany, Munich. This is GAF AG Company (AG 2016), which have had some projects in the agriculture. One of the projects was about investigation of the potential benefits of the remote sensing for biomass conversion plants with the estimation of fluctuation in the investment costs and the level of the greenhouse gas reduction (Biomassmon 2016) .

Apollo Mapping is a company in USA, which delivers the satellite images to the customers. The company has three employees, two of them are sales persons and one is a technician. Apollo Mapping positions themself as the satellite images provider for the academic, engineer, map enthusiast or business owner in order to satisfy the data needs about geospatial, remote sensing and mapping. The firm collaborates with DigitalGlobe, Airbus, RapidEye and ImageSat. Apollo Mapping works via email request at almost any time of the day or night and reply within five minutes. Apollo Mapping has worked with some cases that can be relevant to our service and described further. The first case is supported by scientific project. The University of Illinois at Chicago had a project that was meant to assist predicting corn yields and monitor crop health in the Midwest region of USA. The main purpose of the project was to help the ethanol plants increase the production efficiently and offer a better price on the biofuel to customers. In this regard, Apollo Mapping provided the satellite imagery combined with ground truth data and weather data to predict corn yields. Apollo Mapping can also offer "near-real time" images in order to give the information about agricultural and economic parameters. The other project has been implemented at the Southern Minnesota Beet Sugar Cooperative that operates a grower-owned sugar factory. The factory used the satellite images in order to predict the yield from the harvested areas for sugar beets in Minnesota (ApolloMapping 2016).

The Apollo Mapping has almost the same advantages as KSAT, such as: round the clock service, flexibility, near-real time data. However, KSAT can offer the IQ service, which aims to provide the analysis of the data instead of images. The other advantage is the satellite images with the resolution around 1 meter, while Apollo Mapping utilizes 5-meter 5-band RapidEye imagery. The position of the KSAT's Svalbard ground station is another advantage and it gives KSAT a unique competitive advantage to capture data from all 14 daily passes a polar orbiting satellite can make (KSAT 2016). It means that with "the real-time data", KSAT can offer and will be able to receive much earlier than competitors.

The DigitalGlobe (USA) and BlackBridge (Berlin, Germany) have been chosen for the analysis as the companies that potentially can provide the service in Europe, particularly in Germany. Apollo Mapping (Boulder, Colorado, USA) was selected due to the fact that the company has working experience with the biofuel plant.

3.4. Environmental analysis

The *Environmental analysis* is intended to identify trends and developments on the macroeconomic level. For this purpose, technological, consumer, political and government trends have been analysed. The technological trends are represented from the biodiesel production and satellite service providers' points of view. This paragraph represents the important factors for the biodiesel plants and the way, in which these parameters can influence IQ service. It helps to understand the area of interests and events outside the business, which may influence IQ service. The government and economic trends show the future changes in demand and how the government policy can affect the supply and demand.

3.4.2. Technological trends: issues, needs and uncertainties that affect the biodiesel producers and satellite service providers

There are some *external* and *internal factors* that can strongly affect the biodiesel production. One of the most significant external factors is the quality of the raw material. Accordingly to EU standards the rapeseed oil must meet specific quality requirements (Dworakowska, Bednarz et al. 2011). First of all this is *the quality of the raw material*. These are the factors that influence the quality of rapeseed oil:

- The quality of the seed and the structure/properties of its native constituents
- Genetic factors (type of cultivar)
- Environmental conditions during the growth of the crop and storage conditions, which set the limitations for the quality of the biodiesel obtained upon processing
- The fatty acid composition of rapeseed oil is determined by genetic factors and thus depends upon cultivar type (Bellostas, Sorensen et al. 2007).

All this information is necessary to have before the raw material is delivered to the factory to forecast the output. However, the satellite images are not the only technology that can provide these data. Drones can monitor all these parameters as well. In this regard, the drones

can be considered as a supplementary service (in case of the monitoring the smaller areas) and can also be a new opportunity. Though, in the case of monitoring the smaller areas, it can be a potential replacement service that is a threat for the IQ service.

The *internal factors are* consist of the manufacturing process features such as: temperature, chemical reagents, production equipment, technological process (Bellostas, Sorensen et al. 2007) that can affect the rapeseed oil quality but do not affect the IQ service.

3.4.3. GOVERNMENT AND ECONOMIC TRENDS

Each branch of the economy is affected by many factors that can determine its further evolution and development trends. The biodiesel sector is influenced by numerous internal and external factors, which caused the necessity to have relevant information in the particular period of time to be able to evaluate the risks and predict the trends in the market. In this regard, biodiesel sector strongly depends on the agricultural commodities, supply chain, fuel and biofuel market, public policy, and government support (Charles, 2013). Simultaneously, the biofuel market (inter alia biodiesel sector) influences the key policy objectives, such as: reducing greenhouse-gas emissions, promoting the security of the energy branch and improving socio-economical situation in rural and isolated areas. Thus, the rules and regulations, which are formed by EU authorities, are under the influence of these factors.

The EU policy is aimed to reach 20% level of renewable energy consumption and 10% of renewable energy in transport by 2020. The main target of the renewable energy consumption is 55%–75% of gross energy consumption in 2050. The Biofuels Directive 2003/30/EC has defined the purpose to reach the share of the biofuels and other renewable fuels as 5,75% from the fuel, which is used in transport. The target was not reached and constituted 4,4% of the total amount of biofuel in transport (Scarlat, Dallemand et al. 2015) in EU and 4,5% of all fuels consumed by the road transport in Germany. Regarding the biodiesel transport sector in Germany, the share of the biodiesel constituted 9,9% in 2010. Actually, the same situation has been observed in the most EU countries, where biodiesel was used as a low blend up to 10% by volume in diesel (Global CCS Institute, 2012). The agricultural commodities, which are related to the production of the biodiesel, are mostly represented by rapeseed (Charles, Gerasimchuk et al. 2013) as a raw material for the biodiesel. However, rapeseed is also a raw material for the food production industry. Hence, demand on the rapeseed for the biodiesel production can cause the rising of the prices for food. Rrespectively, if domestic supply of the

rapeseed does not satisfy demand in the biodiesel sector and food industry, the producers will have to find the raw material in the other countries. Important to mention that the population growth is one of the factors that affects the market. Taking into account the sharp increase in population due to immigrants in Germany, we may assume an increase in demand on the fuel in general and on the biodiesel inter-alia.

3.4.4. CONSUMERS' TRENDS

When conversing about consumer trends, we usually mean the changes in the "old way of doing things " and in routine. Biodiesel plants are used to buy the raw material from the farmers' syndicate, which united small and medium size farmers. Some of the plants have farms as affiliated undertaking. However, all of them harvest the raw material during two weeks and it is very difficult to predict time, volume and quality that will come to storage and production line. In this regard, the calculations of the storage, transport and plant capacity become an issue. During this period the plant can suffer from additional costs due to the deviations from the planned indicators. Nowadays, some companies try to find a solution for this pain using the drones as it was mentioned in the technological trends. However, this decision can help just the small plants. The medium and the large size factories need less time for consuming and more effective source of information.

3.5. MARKET STRATEGY

Strategic marketing primarily involves strategic thinking (Zinkhan and Pereira 1994), which is embodied in analyzing internal and external factors that can influence the service, planning of the marketing activities, decision making process, the embodiment of the strategy into practice, and monitoring of its implementation (Reza 2015). Regarding the novelty of the IQ for the biodiesel sector, SWOT analysis was chosen as a strategic planning tool for the evaluation of the Strengths, Weaknesses, Opportunities, and Threats of the service. Thus, the factors, which are favorable and unfavorable for the project, will be determined further. That will help achieving the objectives of the project. Despite that, it is a bit early to plan precise activity for the IQ in this stage, there are some steps that can be used as a basis for future marketing strategy. The following sections outline the SWOT analysis and marketing mix (4Ps) strategy that include some general ideas on how to position the service in the market and promote it in order to use the brand along with marketing related responsibility that offer certain activities for the implementation of the strategy.

3.5.2. SWOT ANALYSIS OF THE IQ SERVICE

In the context of the commercialization, it is important to define in details the strengths, weaknesses, opportunities and threats that are commonly known as a SWOT analysis. The SWOT analysis identifies the crucial factors for realizing the goals. Strengths and weaknesses represent the internal factors that can impact the project. The strengths of the IQ idea indicate what makes the IQ product different from the other providers and the availability of the resources for this product. Touching upon IQ idea, it is important to note that the product innovativeness opens up opportunities of positioning the product in the totally new market with the view of finding afterwards a niche of this market where the technology can be unique. The IQ allows receiving the valuable information in the real time and consequently save money and mitigating market and financial risks. The adaptability to the clients needs makes the product flexible to the market fluctuations. In more detail, the customer can receive the data from the satellite images via the application that can cover any area according to the request of the customer. In the view of the resources availability, IQ has a big potential, which is primarily related to the presence of the brand name. KSAT is a world-leading provider of ground station services that is due to it unique locations and professional team structure. KSAT also has certain financial and information resources in order to diversify the array of services and expand into new markets.

The weaknesses can be the lack of certain strengths and IQ idea is vulnerable primarily due to that fact that the satellite technology is not well known on the biodiesel market and implies high price. Also, IQ idea is the new innovative solution for the biodiesel sector that is lacking credibility since information about the service has not been provided to users and there are no players who would reap its benefits and have enjoyed the positive results. For this reason, the experience and network for IQ are not available. The other weaknesses concern with the government policy that may significantly affect the market and, thereby, indirectly affect the demand for the IQ service.

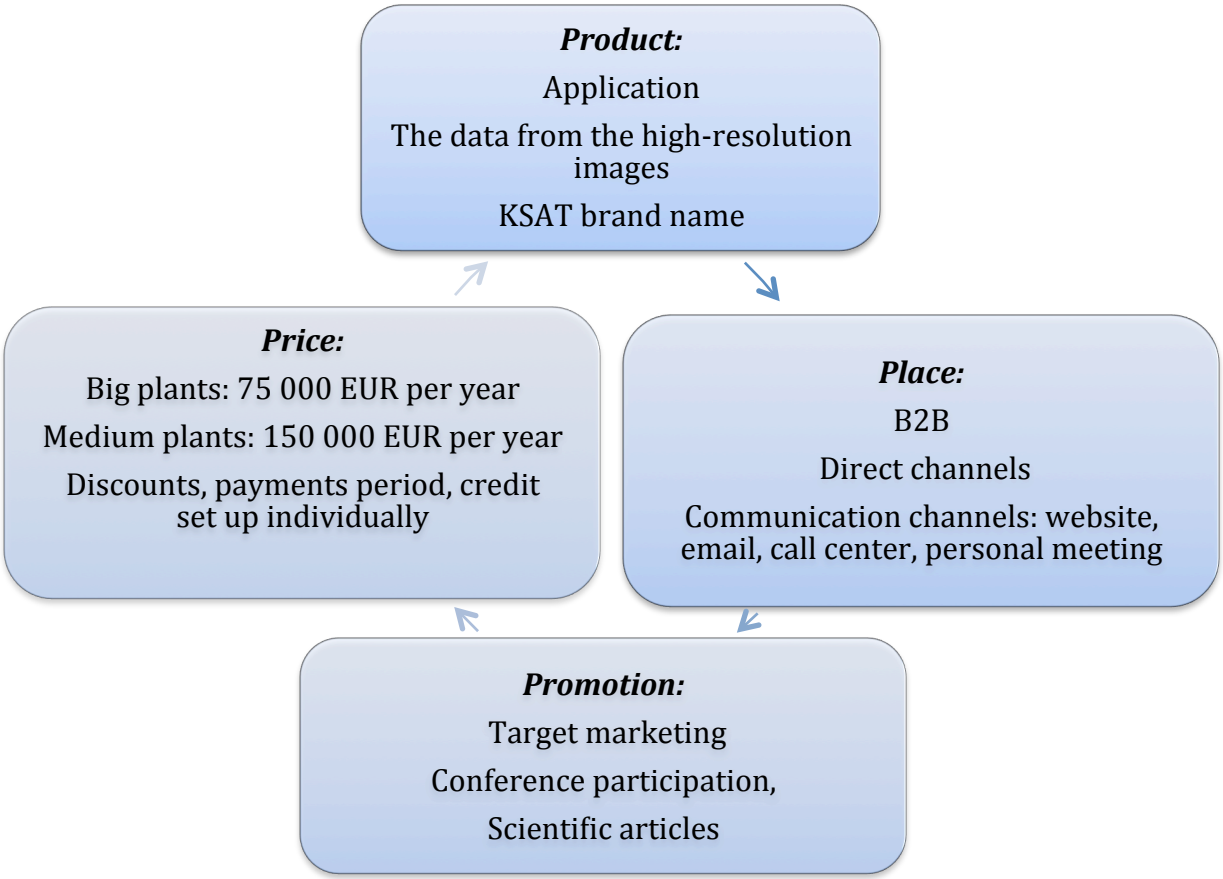
The internal factors can influence the service as well. These factors are represented by opportunities and threats, which are affected by macroeconomic factors, socio-cultural changes, legislation, government, and political situation. The assessment of the external environment in the biodiesel sector can bring the new opportunities for the IQ idea. One of them is an innovative approach that IQ service provides. The most of the biodiesel companies, especially medium ones, use the Internet as a main source of the information and

they do not have the complete picture of what is happening in the market. The small factories use drones to obtain the images from the nearest areas. This leads to the inability of many players to foresee the future trends, market fluctuations, and respond quickly on the force major situations. IQ allows receiving the accurate and current data that influence the quality and speed of the decision-making process. That unique characteristic has potential to open up the new segment of the market and become a "Must have" for the market players with the eye to be well informed about the recent changes. This service has also potential to be spread world wide because of the possibility of the rapid updating of required information and flexibility. In addition, the pre-pilot along with pilot project can play important role for the service commercialization by generating trust and establishing credibility to the new service. Despite that, some unfavorable changes in external environment may pose threat to the IQ service, such as: tax increase and economic instability, which are associated with government policy, political situation in the world, potential changes in the market structure, and dependence of the biodiesel sector from the oil industry along with currency exchange rate. The threats can also come from the changes and customers needs, plus, in the case if the consumers prefer "the old way" of doing business. This analysis helps planning future strategic actions, allows achieving the objectives and finding the competitive advantages, which the IQ idea includes. The SWOT analysis for the IQ idea is represented in the Figure 15 in Appendix.

3.5.3. MARKETING MIX STRATEGY (4PS)

For this stage of the service development is very important to choose the right marketing techniques that can assist to implement and execute the marketing strategy. For the purposes of the IQ service development, the 4Ps have been chosen as a marketing technique that describes the strategy components, such as: Product – Place –Promotion – Price. The marketing mix strategy is focused on the product and gives the direction for the developing the marketing strategy. However, the 4Ps aim selling a product, but IQ service is about selling a *solution to a problem*. In this regard, we use the marketing mix strategy (See Figure 9 below) on the very early stage of the service development in order to select the target market and positioning.

Figure 9. The marketing mix (4P's) of the IQ.



PRODUCT: THE IQ SERVICE DESCRIPTION AND VALUE PROPOSITION. LIMITATIONS

IQ aims to provide the absolutely new service to the biodiesel market. The service offers the data from the satellite images, the analysis of these data, which are delivered via application. The uniqueness of the service is caused by availability of the wide range of the data in the near-real time. Therefore, *the actual service is the agricultural and logistic data, which are available to the customers via the application.* The unique advantage of the IQ service is the high-resolution images that insure the best quality and accuracy of the data. This service offer the unique information for the client that can be used for the short and long-term management.

Due to the fact that IQ is a new service and have to earn the customers trust, KSAT brand name can help to establish credibility to the service. In this regard, trust is the crucial point because the clients, who need this type of information are the large and medium biodiesel producers.

The IQ service is based on the satellite technology, which provides unique pole-to-pole coverage, including the largest ground station in the world and remarkable facilities transmission of the data processing (KSAT 2016). The IQ can deliver information to the customer in the near-real time (14 times per day) from any part of the world and provide analysis of the received data.

PLACE

IQ service can be spread to world wide and applicable to many different industries that have needs in the near-real time information that can be received via the satellite technologies. However, this is business-to-business sale that can be provided to customer via the application. Personal meeting are also available. The customers network creates in the very beginning by participation in industrial conferences and, afterwards, through the professional network. The IQ service is distributed through direct channel that means that product sells directly to a consumer without intermediaries' participation.

PROMOTION

Promotion of the IQ service can be accomplished by the website, advertisement (Balta 2015), network creation (Aarikka-Stenroos and Sandberg 2012), the education (Woodside, Biemans et al. 2005) of the particular market or by combination of these ideas. In this regard, the following paragraphs present the general action plan for the promotion strategy.

This plan represents two different types of the activity. The first one is directed to the customers, their awareness, and needs. In this regard, IQ can operate on the following directions: target marketing, improve customers' awareness, enhance the customer satisfaction, acquire customer loyalty, and use of social media branding. *Target marketing* includes delivering the information that will assist to reduce costs and mitigate the risks. For example, if particular region in Germany has suffered from hurricane or storm, the IQ can draw the customers' attention by offering the accurate, timely and precise information about losses, and help to find undamaged region. Direct mailing campaign is relevant during the harvesting period in order to help evaluating capacity. The publications in the scientific magazines and biodiesel-oriented web sites will *increase customers' credibility and educate the market*. It can be a new magazine like Remote Sensing Applications: Society and Environment (ELSEVIER) that has been presented on the ECO-BIO-2016 Conference in the

Netherlands or web magazine like Biodiesel Magazine (Magazine 2016). Clear and powerful website should be designed to help *enhancing customers' satisfaction* and to *acquire customers' loyalty* through, for instance, providing loyalty campaign. *Social Media Branding* is intended to spread the information via Facebook, Twitter, YouTube, and incoming links to the web site with a view to create an information field around the service and popularize IQ.

The second type of the marketing activity aims to increase the brand and sales person strengths by increasing the sales person qualification, motivation, SCR-management and brand audit. To make *the sales person* show good results we have to ensure favorable work conditions and offer the opportunities for the professional growth. For these purposes, the company should constantly improve the sales person qualification via training, participation in conference and discussion cases within the team. Clearly defined list of powers, properly equipment, realistic target weekly, fortnightly, monthly, quarterly meeting, monetary incentive for sales people, monthly and yearly reports and error free database are "the must have" conditions for the IQ success. CSR and brand audit can be applied later after the launching of the IQ service in the market (Reza 2015). All these objectives of the marketing strategy and methods of their implementation are represented on the Table 7 in the Appendix.

PRICE

Before the pre-pilot along with pilot project will be held, it is a bit early to think about the actual price of the product because of the size of the market and different needs of the customers. Albeit, taking into consideration the position of the service in the market, the price strategy should be determined. The Apollo Mapping's price for the one image varies from 1000 USD to 2500 USD depending on the resolution of the image. However, they buy the images from the bigger companies and pay for between 600 USD to 2000 USD. The average image covers 10 hectares. (See the Table 5 in the Appendix). However, IQ average price will be calculated as a subscription fee for the year. The big biodiesel producers will pay around 150 000 EUR per year and the medium one - 75 000 EUR per year. Discounts, payments period, credit terms depend on the size of the company, and frequency of the IQ service use. These terms are set individually and prescribed in the contract.

3.6. CONCLUSIONS

The aim of the marketing study was to determine the IQ service position in the market in order to predict future trends within the biodiesel sector. For the purpose of this project, the German biodiesel sector and their place in the EU and the world market has been investigated. The marketing analysis helps to assess the perspective and great potential of the IQ service, which due to its versatility can be used worldwide by all market actors. That is why IQ can become "mast have" service in the market. The market analysis determined the range of the players that can be customers of the IQ and gave valuable insights about benefits that can be received. Furthermore, according to the processed data, the main customer's needs and problems come down to the lack of information in a particular period of time that does not allow making the right timely decision or prevent unexpected situations.

Despite the market needs for this service, there are many factors that can affect the successful launching of the product in the market, such as: government policy, socioeconomically factors, current currency exchange rate and low price on the fuel. However, the last factor can benefit IQ and give enough time to finish development of the service and prepare it to the commercialization stage. In this regard, pre-pilot along with pilot project can be the best solution that gives an opportunity to investigate customers' needs properly and examine it in order to determine the presence of the innovative discovery and additional features. In addition, pre-pilot and pilot projects should be started with the purpose of collaboration between the biodiesel plant and the IQ that can result in the development of the IQ application and offer the new problem-solving instrument to the market players.

4. BUSINESS PLAN

Satellite technologies can offer new solution for biodiesel market that aims to reduce biodiesel production costs up to 25 % and mitigate production risks. The technology provides high quality, accurate agricultural and logistic data in the near-real time. The information about yield, quality, timeline and volume of the raw material, which should be delivered to the biodiesel plant, is crucial during the harvesting period and allows calculating precisely plant, transport and storage capacity.

Nowadays, the remote sensing technology is widely used in maritime, oil and gas sector but with other purpose. The remote sensing technology has potential to be applied in the biodiesel sector, spread worldwide and become "must have" service in the market. In this regard, pre-pilot along with pilot project are the best solution to start with. The pre-pilot and pilot projects will verify and correct the calculations in the business plan and add credibility to the service. The pre-pilot project aims to define crucial agricultural and logistic parameters and test their application at the biodiesel plant. The pilot project will test the application (further IQ app) that will be developed as a result of the pre-pilot project. The pilot project will show new opportunities by searching the routine of the biodiesel production.

The start up is seeking funding for the first year. In this regard, we suppose to attract investments from the public and private funds. Despite that fact, that the company's staff represented just by CEO, our team includes many skilled persons, who are the Board members. This project is a real challenge and a big opportunity at the same time.

4.1. BUSINESS IDEA, MISSION AND VISION

Nowadays, speed of decision-making is not only a competitive advantage but also an effective tool for reducing the company's costs. Costs of raw material for the biodiesel plant constitute around 70-95 % of the total production cost (Ahmia, Danane et al. 2014). It means that if a biodiesel plant can decrease their costs on the raw material on 25% by making crucial decisions in the short timeline it can dramatically influence their profit. For this purpose, company needs to receive accurate and timely information from reliable sources. In this regard, the agricultural and logistic data about the particular area in the near real time can be provided to the customer via IQ app. These data can indicate the amount and quality of raw material (rapeseed in this case) both from the nearest suppliers and from suppliers that

are far away. Thus, based on market analysis, the biggest needs for this type of the data have biodiesel plants, which are considered in this business plan as the main customers. A medium-size plant with 100 000 tonnes yearly production capacity has been chosen for the pre-pilot and pilot projects. For this purposes Kongsberg satellite services (KSAT), the satellite images provider, set up a new start up that will initially specialize on the biodiesel sector. The start up will provide the "Inquire the Quality" or IQ service. The IQ service will be introduced to the biodiesel plant in Lithuania, which is the partner for the pre-pilot and pilot projects, during the first year in order to create and test the IQ app.

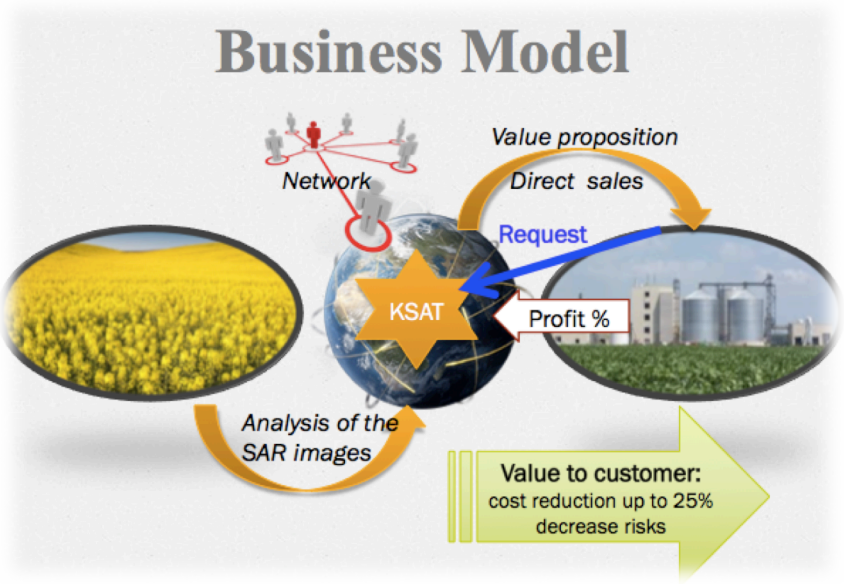
The IQ service fully complies with the mission of the KSAT, which is declared on website of the company: *"At KSAT we have made it our mission to ensure rapid access to data and delivery of services through a set of well equipped, modern ground stations spread out around the globe"*.

Moreover, the IQ service will lift up KSAT to a new level. Our vision is to provide the worldwide service that will allow using financial, human and agricultural resources in the most effective way in the biofuel sector to be able to reduce risks costs and reach sustainability. Starting with the pre-pilot project 15th of June 2016, we are planning to work with the Lithuanian biodiesel plant till 15th of December 2016 and finish with the ready app. The pilot project will start 9th of January 2017 till 15th of June 2017 with the same plant aiming to test and improve the IQ app.

4.2. BUSINESS MODEL

The general plan on how to generate the revenue and obtain the profit from the IQ service is presented as the business model on the Figure 10 below. Business model canvas is represented in the Table 8 in Appendix.

Figure 10. Business model of the IQ service.



The IQ receives from the customer request about investigated area. After obtaining the images from the particular area from the satellite, the data is processed and obtained parameters are provided to the customer via IQ app. The data contains valuable information about the yield and quality of the raw material that allows reducing production costs on 25% and decreasing risks to buy law quality raw material. The price of services is calculated accordingly to the number of hectares of the investigated area. On average, one image can cover 100 km^2. That image is of high quality (from one meter to 30 centimeters resolution). The average market price of the one high quality image is around 2 500 USD or around 25 000 NOK (which has been used for the budget and cash flow calculations). One medium size biodiesel plant needs at least several series (at least 10 each) during the harvesting period to be able to calculate transport, storage and plant capacity. Hence, the average price will be calculated depending on the number of the hectares as a subscription fee for the year. This model is based on direct sales and direct distribution channels for the business.

4.3. Management team

Management

From the beginning of the project and until 2018 the management team will be represented by Board members and owner. The Board members are:

Fredrik Landmark (the Board Chairman), Sr. Vice President who is responsible in KSAT for the Business Development, Sales and Marketing and has knowledge and experience about the satellite service market;

Anastasia Leonenko. Currently, she is adviser at Tromsø Centre for Remote Sensing. Anastasia has good knowledge and skills in the project development, management, leadership, research development, network establishment nationally and internationally, PR and strategy, funding.

Lene Wium who started in Norinnova in May 2013 and works as Senior Business Developer in the incubation team. Previously she has 15 years of work experience in sales, business development and strategy work in various industries;

Torbjorn Eltoft, the Head of the Center of integrated remote sensing and forecasting for the Arctic operations (CIRFA), professor in Physics and Technology, has experience in earth observation, signal and image processing and remote sensing.

The owner is Maryna Vakulenko (100 %). The position of CFO will be appointed by KSAT in order to reduce project costs. In 2021 we expect to have one sales person position and several temporary technician positions.

KEY EMPLOYEES

Maryna Vakulenko – CEO

Previously a CEO at Interdeli AS (Norway) and CEO at Implantis AS (Ukraine). Maryna has good knowledge and skills in start up establishment; strategic thinking; financial analysis; marketing strategy; staff management; risk management and negotiations.

Recently, Maryna has been completing a Master's in Business Creation and Entrepreneurship at the University of Tromsø.

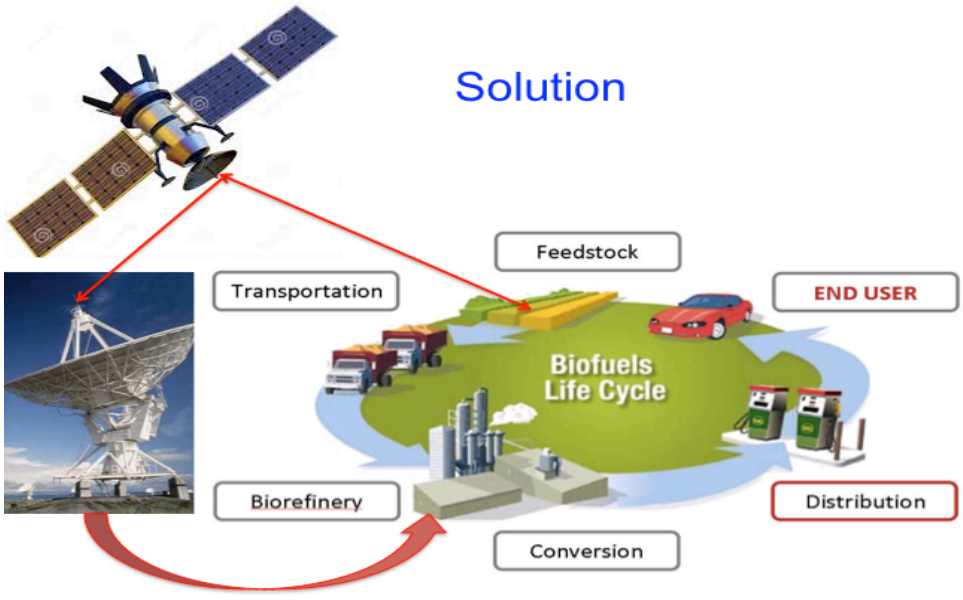
Position of *CFO* will be appointed later on.

4.4. SOLUTION (PRODUCT/SERVICE)

The IQ service is based on the delivery of precise data to customer (the biodiesel plant) by receiving the images of the particular area and delivering the data to the customer (See Figure 11). Satellite images are comparable with the perception of the world by human eye. It means that the colors that we can see are the same. However, a satellite sensor can capture much more data than we can see. It means that we can analyze not just the visible things but also a range of other wavelengths of energy. It can be electromagnetic, infrared or even microwaves that help forecasting rapeseed yields, for example, in the particular area. The sensors we've mentioned above can detect how this energy is transmitted, absorbed or reflected. It strongly depends on the object characteristics like shape and texture. As a result we receive a grid-like picture of individual pixels with some digital markers. It helps to find the difference among the objects depending on their reflectance properties. For example, we can differentiate agricultural land, forest or water.

Usually, the business plants have to sample occasionally this data from the rapeseed fields manually. However, they can't analyze properly the whole field, which is around 25-50 hectares because it is very expensive and time-consuming process. That is why they make small samples from the field and make analysis of the prepared samples. The received data usually has not a high accuracy and come within a working weak. That is why the IQ app is a good solution in order to obtain the accurate data in the near-real time and keep it updated.

Figure 11. IQ service: technical solution.



4.5. MARKETING PLAN

4.5.1. CUSTOMERS

IQ customers are represented mostly biodiesel producers in need for accurate data to be able to reduce costs and mitigate risks. There are around 200 potential customers of the IQ in European Union (EU). We are aiming to cover around 15% of the European market that will constitute 28 biodiesel plants in 2021. The first potential customer is the Lithuanian biodiesel plant with 100 thousand tonnes capacity per year, which has agreed to take part in the pre-pilot and pilot projects. The plant can enjoy free data during pre-pilot and pilot projects and, then, buy the service. The Rapeseed producers, consulting companies and stock exchange players can be considered as potential customers as well.

4.5.2. COMPETITORS

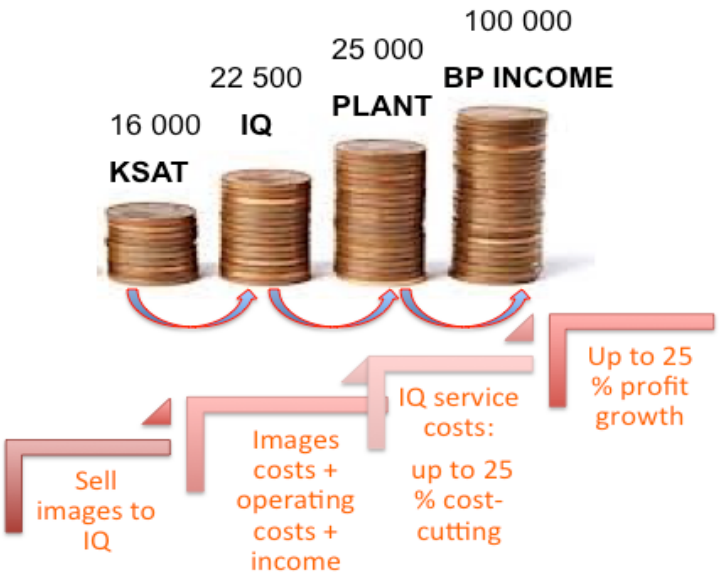
We consider three potential competitors for this service. They are DigitalGlobe (USA), BlackBridge (Berlin, Germany) and Apollo Mapping (Boulder, Colorado, USA). These companies have experience in applying of the remote sensing technologies in the agriculture. DigitalGlobe (USA) and BlackBridge (Berlin, Germany) have the broad networks to spread the service worldwide. Apollo Mapping (Colorado, USA) has provided the satellite images to biofuel plant in the USA and customers extract the necessary parameters by themselves.

4.5.3. MARKETING STRATEGIES

PRICING

The price is based on the customer's cost-cutting figures and the KSAT price per one image. The average market price for the biodiesel plant per one image is 25 000 NOK. The pricing model is described on the Figure 12 below.

Figure 12. The IQ service Price Model (NOK).



However, the price for the customer will be presented as the yearly subscription fee. The big biodiesel producers will pay around 1 500 000 NOK per year and the medium one - 750 000 NOK per year. The final price will be discussed individually and will depend on the area that customer interested in.

SALES

We based our sales calculation on that fact that 70-95% of the production costs for the biodiesel plant constitute the raw material costs. Hence, the raw material costs constitute around 1 455 000-1 843 000 EUR for the biodiesel plant in EU with 100 000 tonnes production capacity per year. It is relevant 70%-95% production costs that were mentioned before. The 25 % margin between these costs is 388 000 EUR. Generally, one medium size biodiesel plant needs the data from around 30 images per year and the data that can be provided via IQ app will cost around 75 000 EUR or 750 000 NOK per year (expected exchange rate 10,00). The IQ is going to have as customers 8 big and 20 medium size biodiesel plants. As was mentioned before, it is 15 % of the European biodiesel market that will constitute 3 750 000 EUR or 35 325 000 NOK (exchange rate 9,42).

DISTRIBUTION

The IQ service will be distributed through direct distribution channels to business (biodiesel producers). The distribution of the IQ service will be started from the presentation of the IQ idea on the 9th Biofuels International Conference in Ghent, Belgium in 22th September 2016. We are going to contact the biodiesel producers, which take part in the conference and start building the customers' network in order to send the information about the IQ service.

SERVICE

The customers can contact us via e-mail, call center and the other way. We provide round-the-clock service during the harvesting period (July-August). Our clients can receive the data via IQ app and have any technical support they might need.

MARKETING

General brand and marketing related responsibility activities include necessary steps and actions that should be done for the IQ service promotion. Objectives of the brand and marketing related responsibility activities include promotional activities, events and sponsorship, gifts and compliments to clients and advertising. Implementation methods are offered for each objective and described in the Table 11 in Appendix.

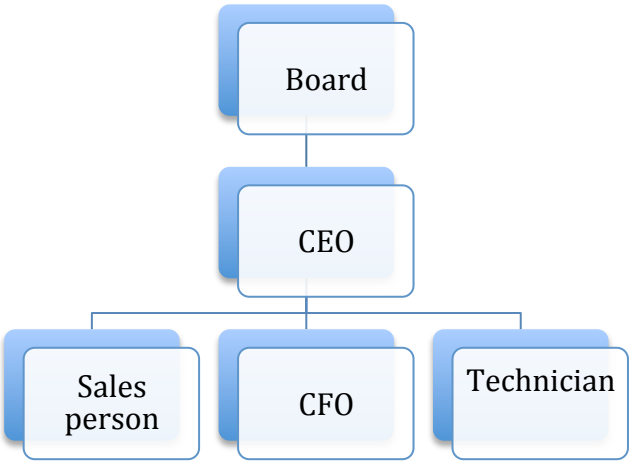
4.6. ORGANIZATION

4.6.1 ORGANIZATIONAL STRUCTURE

The Board approves and controls decisions made by CEO, which relate to funds, loans, decisions about significant material transactions or other important issues. They define level of materiality and keep in view some specific circumstances of the company. The CEO duties are company´s structure creation, sales, operations, marketing, strategy, financing, staff etc. The CFO is responsible for accounting, company's present financial condition, economic forecasting and modeling. Sales person and CEO in the very beginning have to find and communicate to the customers. Technician will be in charge of the technical parameters and responsible for updating the app. The scheme of the organizational structure is represented on the Figure 13 below.

The IQ will be established as a Limited Liability Company.

Figure 13. Organizational structure.



4.6.2 Partners

KSAT is the technical partner that will provide satellite images and give the technical support. We expect to receive an office and equipment support from the Arctic University of Norway, UiT (represented by CIRFA) for the first two years. We are going to apply for financial support to Innovation Norway in order to establish the company and to Research Council of Norway to receive funds for the pre-pilot and pilot projects. The biodiesel plant in Lithuania, UAB Rapsoila will be partner during the pre-pilot and pilot projects.

4.6.3 Owners

Maryna Vakulenko (100%) is the company owner.

4.7 Production

IQ receives ready satellite images from the KSAT, extract the logistic and agricultural data and then provides it to the customer via IQ app.

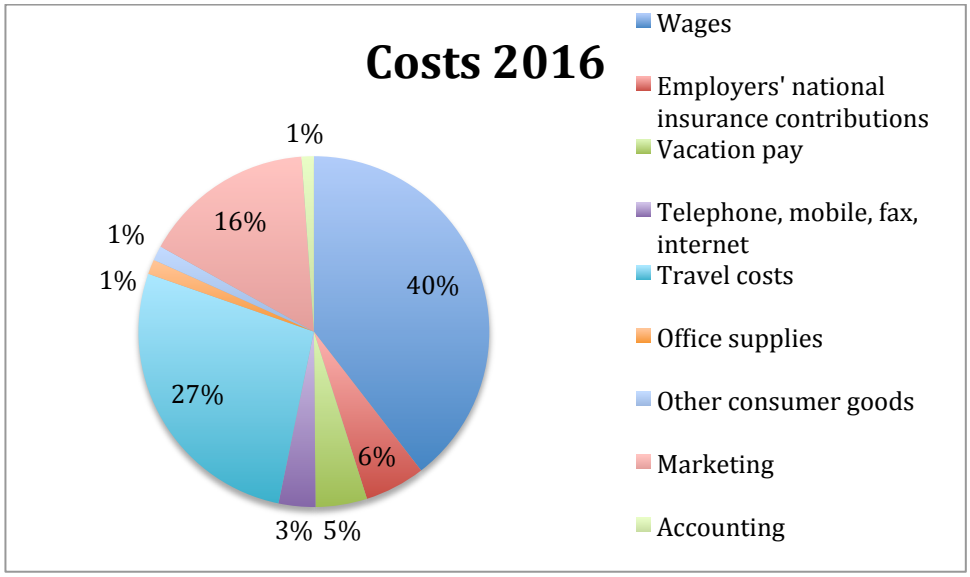
4.8 Economical overview

4.8.1 Cost structure

During the pre-pilot project in 2016, cost structure will consist of the wages (including insurance and vacation payments), travel costs, marketing and other payments that include

office supplies, telephone, internet etc. The cost structure will change the project implementation until 2021. The cost structure for the pre-pilot project, 2016 you can find on the Figure 14 below and for the 2021 year and in the Income statements (See Figure 16 and Table 9 in the Appendix)

Figure 14 the cost structure for the pre-pilot project, 2016



4.8.2 INVESTMENTS AND CAPITAL NEED

We expect to have 100 000 NOK from the Innovation Norway in order to establish the company. For the pre-pilot project we need 443 000 NOK. This money will be spent mostly on the wages, wages payments, and insurance, marketing search, travelling and service production. For the same purposes we are going to spend 390 000 NOK for the first half of the 2017, when the pilot project will be carried out. We assume that KSAT will provide free satellite images and technical support for the test-project and Tromsø Centre for Remote Sensing will grant the working place, telephone, Internet and other additional supplies during 2016-2017 years (See Table 9 in the Appendix).

4.8.3 ECONOMIC SITUATION, FINANCING AND BUDGET

We assume selling the data to one customer via IQ app for 750 000 NOK per year. The production costs or the image provider's price is 480 000 NOK per one customer. Thus, a gross margin for the one customer is 270 000 NOK per one image or 36 %.

We plan to start the pilot project in January 2017 after visiting the 9th Biofuels International Conference (Ghent, Belgium) in September 2016, where we anticipate presenting the results of the pre-pilot project. First sales are expected in July, August 2017 during harvesting period in 2017 to three biodiesel plans. The first data will be delivered to three biodiesel plants in Europe. Afterwards, we expect to have a growth of the customer base up to 10 plants with the revenue 7 500 000 NOK in the 2018, 15 plants (with the revenue 11 250 000 NOK) in the 2019 and 20 plants (revenue 15 000 000 NOK) on the 2020 year. We expect to start working with the medium plants and from 2021 with the large, when we planning to have as the clients 8 big biodiesel plants with capacity more than 200 000 tonnes per year.

Cost of the goods sold does not change during the whole period and constitute 64% from the revenue. The operating costs decrease from 34,1 % in 2016 to 9,4 % in 2021. The Net income starts in 2017 from 1,4 % from the Revenue and constitute 19,1 % in 2021. The project investments are paid off in 2018 and exceed investments (around 1 000 000 NOK) in 11 times (11 120 000 NOK) (See Table 9 in the Appendix).

However, accordingly to the Cash flow statement (see Table 10 in Appendix), there are some difficulties with cash flow, because the customers pay during the harvesting period (July and August). In this regard, the special service package should be worked out during the pilot project that will allow receiving the payments gradually over the years as a subscription fee.

4.8.4 EXIT

In case of some difficulties with the launching the product in the market or some unexpected issues during the commercialization stage, the completion of the project will require one more year. If the company's successful development will be impossible, it will be sold to the global companies that described in the Marketing Study, section Competitors.

4.9 EXECUTION

During the launching of the service in the market we assume some problems and risks. The first difficulties will come before the pre-pilot project will start (summer-autumn 2016). We expect to receive the funds by 15th of June 2016 in order to start parameters investigation during the harvesting period. However, it will be a bit challenging process. In order to reduce this risk, we try to receive funds from several different sources. The other issue can happen

during the pilot project. It can be less successful than we expected. In this regard, we will search additional needs in precise data that can have a biodiesel plant and will change the calculations. We expect to finish the pilot project on the 15th of June 2017. However, at the same time, in July-August 2017 we assume to have the first three customers. If the customers will not be found, we have to postpone the first contracts until 2018 year. On this stage we have a financial risk because we will need extra funds to continue the research of the product (around 800 000-900 000 NOK). To mitigate this risk, we are going to present our service on the agricultural and scientific conferences, which participants can be potential IQ customers. For this purpose, the market study and business plan will be changed. The final risk is a suddenly big demand on the IQ service, which will not allow us to deliver the high quality service to the all customers. This situation is very dangerous because we risk losing reputation and trust. To prevent this situation, we will start finding potential team members for the IQ and at the same time thinking about IQ app design. No doubt, we will face with some unpredictable issues and problems. However, we think that our passion to this project, motivation and hard working will help us to offer the radically new solutions for the old problems in the biodiesel sector.

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APPENDIX

Table 5 Interview with Brock Adam McCarty from Apollo Mapping (USA), which have had the working experience with biofuel plant.

Questions	Answers
How and where from the biofuel plants get the information about the raw materials?	Farmers corporative, Internet, drones, satellite images (seldom)
Do biofuel plants use the nearest fields as a source of the raw materials?	It is possible. However, some of them prefer to make a deal with the farmers corporative.
What is the biggest problem or needs, which biofuel plants are faced buying the raw material? When it occurs?	The plants, transport and storage capacity are limited. Farmers usually harvest during the same period of time. That is why they need very accurate information about the harvesting volume, quality and location.
What kind of information can the biofuel plants be interested in?	Which field to harvest; the quality; where the biggest productivity; timeline.
How does Apollo Mapping work with biofuel plants and who are your main clients?	Apollo Mapping has not many biofuel plants as a clients. Small biofuel plants prefer using drones. It is cheaper. However, drones can't cover a big area for the short periods of time. Our biggest clients are research institutions.
Which resolution of the satellite images is usually biofuel plant required?	Usually, they work with high resolution satellite images (1 meter- 30 centimeters)
Which distance can be covered by one satellite image?	10 000 hectares or 100 square kilometers in average
What do the images cost for Apollo Mapping?	600 UDS- 2000 USD for the one image, depending on the resolution
Which price do biodiesel plans pay for the one image? How many images do they usually need at the same time?	1000 UDS- 2500 USD for the one image, depending on the resolution. In average they can use series of images that exceed 10, depending on the biodiesel plant size.
Do you provide to your customers just images or reports as well?	Just images. They make analysis by themselves.

Is there any possibility to use satellite data for the consulting and stock exchange companies?	Yes, possibly. However, this is a very large field that should be analysed separately.
What kind of restrictions does exist for the satellite images market?	It depends on country and legislation in this country. It can be resolution restrictions or some "black areas".
What are your customers satisfied with?	The most important is the quality of the images and high resolution. Then time and accuracy

Table 6: Interview with Rolandas Gabstas CEO of Pasvalio agrochemija UAB (biodiesel plant in Lithuania).

Questions	Answers
How and where from the biofuel plants get the information about raw materials?	We use information that farmers declare and via observation
Do biofuel plants use the nearest fields as a source of the raw materials?	It depends on many factors. Mostly, we try to choose the best quality raw material by appropriate price.
What is the biggest problem or needs, which biofuel plants are faced buying the raw material? When it occurs?	Quality issue. We need to observe it from April to June-July.
What kind of the information can the biofuel plants be interested in?	We need to know the oil content of the rapeseed and some other parameters to be able to conduct the contracts in July-August.
Would you use the data extracted from the satellite images?	Is it possible? Of course, we will.
Do you need the data in dynamic?	Yes, we do.
Would you take part in the pre-pilot project in order to test the satellite technology for the biodiesel market purposes?	It will be very interesting experience for us, however the commercial information that we can provide for the research are restricted.
Questions that touch upon economic, finance and production belong to the commercial secrets.	

Figure 15. SWOT analysis for the IQ service (Balta 2015).

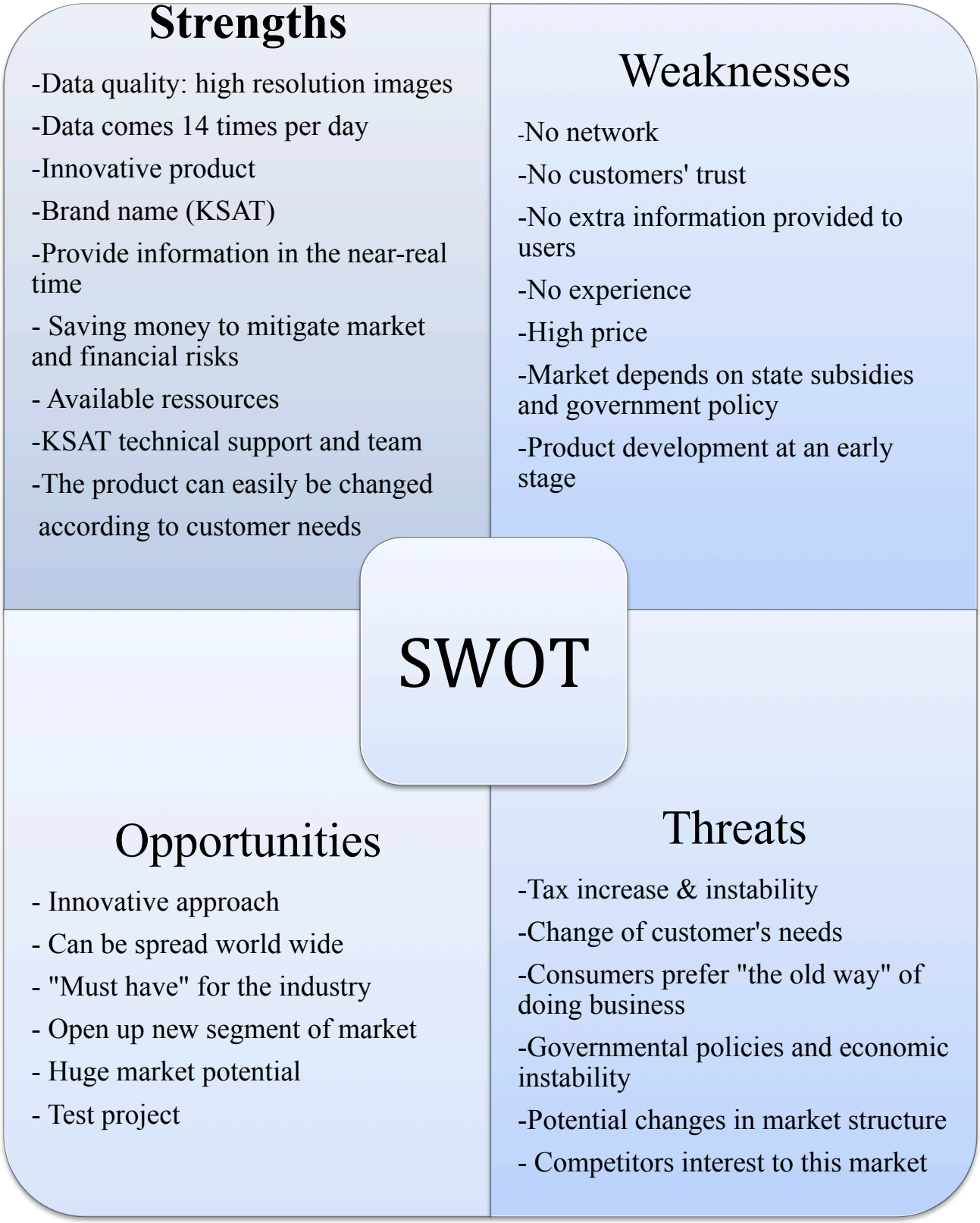

Table 7. The plan of actions for the IQ marketing strategy (Reza 2015).

Objectives of the marketing strategy	Methods of implementation
Target marketing	E-mail marketing Direct mailing campaign Personal meeting
Improve customers' awareness	Publication in the press, including professional magazines Publication on the specialized web sites News letter circulation Advertisement in Professional Forums Sponsoring the sport team or event Anniversary of branding
Enhance customer satisfaction	Easy and clear website Availability of the information via the application Direct consulting
Acquire customer loyalty	Customer loyalty campaign Sending appreciation note to customer
Social Media Branding	Facebook Branding Twitter Branding Videos on YouTube
Sales person qualification	Sales person training Clearly defined list of powers Sales person are properly equipped Error free database
Motivate sales person	Realistic target Weekly, fortnightly, monthly, quarterly meeting Monetary incentive for sales people Monthly and yearly reports
CSR	Sport clubs support Support the new university projects Support of the new researches
Brand Audit	Confirmation that the brand is properly managed

Table 8. Business model canvas of the IQ service.

<table>
<tr><td rowspan="2">Key Partners:

• KSAT

• Norinnova

• CIRFA

• UAB Rapsoila</td><td>Key Activities:

• Sales

• Marketing

• Promotion</td><td rowspan="2">Value Propositions:

• High resolution

• High accuracy

• Real time data

• 25% cost-cutting

• Additional revenue generation

• Risk mitigation

• RIQ app</td><td>Customer Relationships:

• Direct contact
• B2B</td><td rowspan="2">Customer Segments:

• Biodiesel producers</td></tr>
<tr><td>Key Resources:

• KSAT: satellite images and technical advice

• CIRFA – place and equipment support

• Norinnova: investments</td><td>Channels:

• Direct sales</td></tr>
<tr><td colspan="2">Cost Structure:

• Buying satellite images (KSAT)
• Marketing and travel costs
• Wages from employees
• Other operational costs</td><td colspan="3">Revenue streams:

• IQ service sales</td></tr>
</table>

Table 9. Income statement (budget) for the IQ from 2016 to 2021.

	2016	2017		2018		2019		2020		2021	
	Kroner	Kroner	%	Kroner	%	Kroner	%	Kroner	%	Kroner	%
Sales revenue	0	2 250	100,0 %	7 500	100,0 %	11 250	100,0 %	15 000	100,0 %	27 000	100,0 %
Cost of goods sold	0	1 440	64,0 %	4 800	213,3 %	7 200	64,0 %	9 600	64,0 %	17 280	64,0 %
Gross profit	0	810	36,0 %	2 700	36,0 %	4 050	36,0 %	5 400	36,0 %	9 720	36,0 %
Operating costs (per. year):											
Wages - employees, monthly salary x 11	175	385	17,1 %	455	6,1 %	525	4,7 %	595	4,0 %	1 050	3,9 %
Employers' national insurance contributions	25	54	2,4 %	64	0,9 %	74	0,7 %	84	0,6 %	148	0,5 %
Vacation pay	21	46	2,1 %	55	0,7 %	63	0,6 %	71	0,5 %	126	0,5 %
Rent	0	0	0,0 %	36	0,5 %	120	1,1 %	120	0,8 %	120	0,4 %
Telephone, mobile, fax, internet	15	15	0,7 %	20	0,3 %	20	0,2 %	30	0,2 %	30	0,1 %

Other travel costs	120	150	6,7 %	225	3,0 %	304	2,7 %	400	2,7 %	500	1,9 %
Office supplies	6	6	0,3 %	8	0,1 %	9	0,1 %	10	0,1 %	18	0,1 %
Other consumer goods	6	6	0,3 %	8	0,1 %	9	0,1 %	20	0,1 %	20	0,1 %
Marketing (advertising, etc.)	70	100	4,4 %	125	1,7 %	156	1,4 %	167	1,1 %	500	1,9 %
Accounting	5	5	0,2 %	35	0,5 %	35	0,3 %	35	0,2 %	35	0,1 %
Sum operating costs	443	767	34,1 %	1 030	13,7 %	1 316	11,7 %	1 532	10,2 %	2 547	9,4 %
Operating results	-443	43	1,9 %	1 670	22,3 %	2 734	24,3 %	3 868	25,8 %	7 173	26,6 %
Earnings before tax (= Res. for pers. selskap)	-443	43	1,9 %	1 670	22,3 %	2 734	24,3 %	3 868	25,8 %	7 173	26,6 %
Tax - 28 % of earnings before tax	0	12		468	6,2 %	766	6,8 %	1 083	7,2 %	2 008	7,4 %
Net income (for companies organized as AS)	-443	31	1,4 %	1 203	16,0 %	1 969	17,5 %	2 785	18,6 %	5 165	19,1 %

Figure 16. The cost structure for the 2021-year.

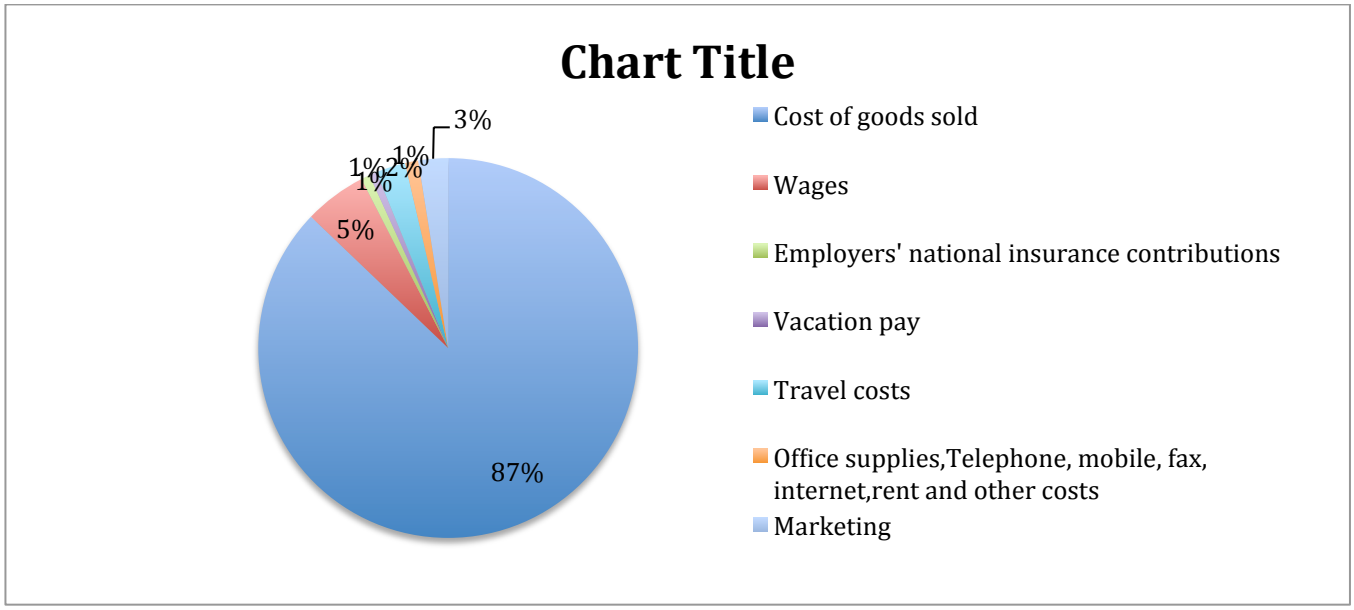

Table 10. Cash flow for the IQ from 2016 to 2021.

	Sum 2016	Sum 2017	Sum 2018	Sum 2019	Sum 2020	Sum 2021
Alternativ capital in the company	443,0	300,0	0,0	0,0	0,0	0,0
Payment from customers		2 250,0	7 500,0	11 250,0	15 000,0	27 000,0
Sum payment	**443,0**	**2 550,0**	**7 500,0**	**11 250,0**	**15 000,0**	**27 000,0**
Business start-up expenses (incl.investments)	22,0	0,0	0,0	0,0	0,0	0,0
Payment of purchase of goods	0,0	1 440,0	4 800,0	7 200,0	9 600,0	17 280,0

Wages and payroll tax	175,0	352,9	352,9	352,9	352,9	1 050,0
Emp-s' national ins-ce contr-s	24,7	47,8	44,8	44,8	44,8	148,1
Vacation payments	0,0	21,0	46,2	63,0	71,4	126,0
Marketing	69,0	100,0	125,0	156,3	167,2	500,0
Other payments regarding management	27,0	27,0	71,0	158,8	180,0	188,0
Accounting	5,0	5,0	35,0	35,0	35,0	35,0
Travelling (not car expenses)	120,0	150,0	225,0	303,8	400,0	500,0
Sum payments	**442,7**	**2 143,7**	**5 653,7**	**8 790,5**	**10 779,9**	**18 212,7**
Sum - liquidity by start-up period	**0,0**	**18,8**	**425,1**	**2 271,3**	**4 730,8**	**8 950,9**
Incomes in this period	443,0	2 550,0	7 500,0	11 250,0	15 000,0	27 000,0
Cash outflow in this period	424,2	2 143,7	5 653,7	8 790,5	10 779,9	18 212,7
Changes in this period	18,8	406,3	1 846,3	2 459,5	4 220,1	8 787,3
Sum - liquidity by the end of this period	18,8	425,1	2 271,3	4 730,8	8 950,9	17 738,1
Cash flow statement	**0,3**	**406,3**	**1 846,3**	**2 459,5**	**4 220,1**	**8 787,3**

Table 11. The general list of the brand and marketing related responsibility activities.

Objectives of the brand and marketing related responsibility activities	**Methods of implementation**
Promotional Activity	Event management Social media branding Exhibits Newsletters Presentations Courses and workshops
Events and Sponsorship	Conference participation Researches support Sport clubs support
Gifts and Compliments to clients	Bags with the KSAT/ IQ logo Branded Pens Calendars
Advertising	Video presentations Annual films Short clips Articles in the professional magazines