UiT

THE ARCTIC UNIVERSITY OF NORWAY

School of Business and Economics

Innovation and Commercialization Potential of University-Developed Arctic Ice-Tethered Platforms

A case study of research-based technology

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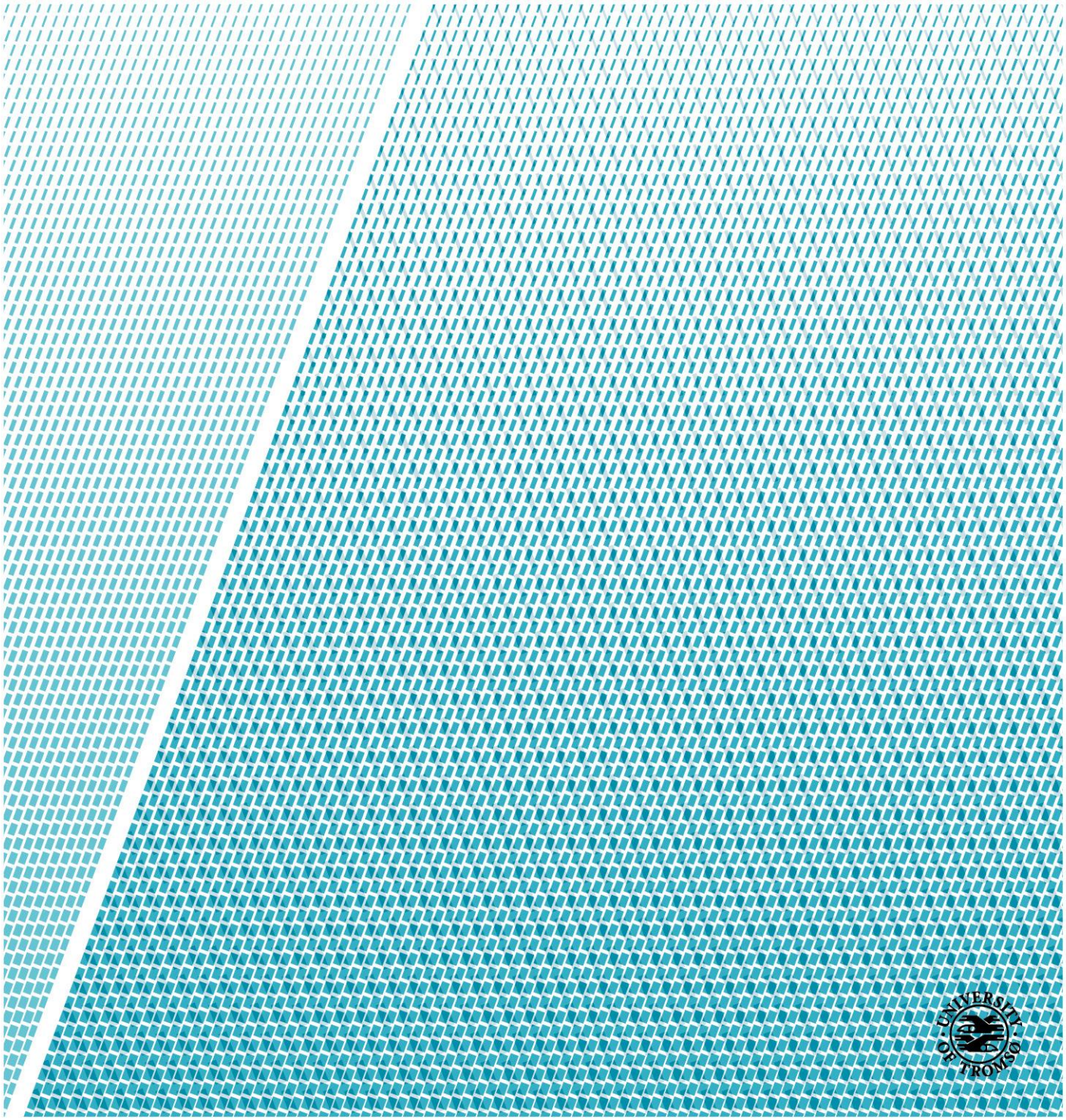
Master thesis in Business Creation and Entrepreneurship – June 2017



Declaration

This thesis is submitted in partial fulfillment of the requirements for the degree of **Master of Science in Business Creation and Entrepreneurship**.

We hereby declare that this thesis is the result of our own original research and that no part of it has been submitted anywhere else for any purpose. All references have been duly acknowledged and we therefore bear sole responsibility for any shortcomings.

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I hereby certify that this thesis was supervised in accordance with the procedures laid down by the University of Tromso, Faculty of Biosciences, Fisheries and Economics.

Elin M. Oftedal (Associate Professor, UiT Business School)

Supervisor.

Dedication

This thesis is dedicated to our parents. Without them, we would not have gotten this far. From birth to daycare, from Nursery School to the Master Degree level, we are eternally grateful.

Acknowledgement

We would not have been able to write this thesis without the help and guidance of the Almighty God. We are grateful to Him for the strength, safe journeys, health and knowledge over the course of the BCE program.

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Stay blessed.

Abstract

The Arctic is a region which is rapidly opening up for business opportunities. However, research has been abundant here for a long time. With this situation comes the avenue to transition technology used in the region from research to commercial purposes. In this thesis, a business case is developed to show the commercial potential of research-based technology. The case technology was developed by the researchers of The University of Tromsø, The University Centre in Svalbard, The Norwegian University of Science and Technology, and the Scottish Association of Marine Scientists. It is a case under the NOK 40 million-funded ArcticABC research project, which presents a new method for measuring, harvesting and analyzing biological, geological and chemical processes within arctic sea ice. Its original purpose is to provide researchers with a means of autonomously carrying out arctic sea ice measurements all year round (including the largely understudied polar winter). However, upon introduction to students at the Business School in Tromsø, it was discovered that the technology can be adapted to also cater to businesses conducting operations in the Arctic, thus enabling the pathway for a commercial plan. Basing on several theoretical and practical methods, the students reviewed the innovative potential behind this technology, identified market segments and developed a packaged solution that has the potential to serve these markets. At the time of the thesis submission, the technology is still being tested and developed to ensure its capabilities, nonetheless, reasonable assumptions and justifications for those assumptions have been made to show how a research-based technology can be feasibly commercialized.

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1 Introduction

The Arctic Ocean remains one of the least explored sections of planet earth. The presence of year-round ice cover means that standard oceanographic technologies for mapping, sampling and exploration of the arctic sea ice region cannot be used. The risk and cost associated with the deployment of manned submersibles beneath the sea ice is high when compared to the use of Autonomous Underwater Vehicles (Kunz, Murphy, & Camilli, 2008). In addition to this, climate change is on the rise throughout the world and the importance of studying the Arctic region cannot be overemphasized (NOAA National Centers for Environmental Information, 2016).

When scholars and researchers talk about climate change, the mind of the common observer goes to global warming due to its popular use (Conway, 2008). However, global warming and greenhouse gases are just a small part of climate change. Conway (2008) says climate change is concerned with "a long-term change in the Earth's climate, or of a *region on Earth*". With regards to the Arctic region, the permafrost which contains a third of the carbon on earth is at risk of melting and turning from a carbon sink to a carbon source (Weather Underground, 2016), hydrological processes and biogeochemical cycles and social systems within the ecosphere are also changing in relation to climate change (Hinzman, Bettez, Robert, Stuart, & Dyurgerov, 2005). Climate change is filled with *uncertainty* in timing, magnitude and direction of change, and more variables which are not necessarily statistical in nature (Woodruff, 2016). Also, most studies on climate change in the Arctic region are viewed from the perspective of the polar summer, while the polar winter is considered as a *black box* which has been rarely regarded and irregularly opened (Berge, et al., 2016).

In relation to this change, human activity in this mildly explored Arctic region is on the rise. As arctic pathways melt, there is an increase in shipping routes along the region and there are more sources for oil and gas exploration. In this view, there is a need to develop a means of measuring physical and biological data to be harnessed as useful information for interested parties carrying all year round to enable or benefit their business processes. To fulfill this need, researchers at UiT - University of Tromsø developed a technology – **The Ice-tethered Platform Cluster for Optical, Physical, and Ecological Sensors** (ICE-POPEs).

Technological progress has been the driving force of many economies. As the products of this progress have become more sophisticated and industries have become more high-tech over the years, universities have come to play a large role due to their ability to perform as resource

pools for the processes of invention, innovation, and commercialization (Litan, Mitchell, & Reedy, 2007). Historically, researchers based at the university have not been concerned with taking their innovations to the industry, but rather student education and basic research (Gold & Srulovicz, 2011). In recent years, however, there has been a trend and increased public interest in encouraging the commercialization of university-driven research. However, an overarching challenge remains that the research faculties which are equipped for doing academic research face the conflicting demand of commercializing technologies and ideas from within their research – for which they generally lack the expertise (Ambos, Mäkelä, Birkinshaw, & D'Este, 2008). To help deal with this issue of conflicting demands, universities set up and provide members access to entrepreneurial faculties, business incubation facilities and technology transfer offices which would foster taking ideas to market (Etzkowitz, Webster, Gebhardt, & Terra, 2000). Thus, the Business School faculty at the University of Tromsø (UiT) is one such setup.

The Business Creation and Entrepreneurship (BCE) program is a department within UiT which serves as a unique solution for transforming such research-based ideas into commercial successes (Hemmingsen, 2016). The technologies in focus are autonomous "Ice-Tethered Platforms" which are capable of gathering a wide range of data about physical, chemical and biological conditions in the arctic sea ice all year round. With the rise of human activity in the Arctic, there is a need to be able to monitor the changes in the ecosphere and biosphere in this region. This thesis was developed by Business School students at University of Tromsø for their Master Studies and analyzes, evaluates, and details the commercialization potential of research-based technologies developed within ArcticABC project of the Arctic Marine Biology department at the university.

1.1 The Importance of the Topic

The ecosystems of the Arctic are filled with high risks due to the ongoing geo-political, geo-economic and geo-ecological interests abounding in the region (Bund.de, 2013). With climate change comes the effect of rapid warming and melting of the arctic sea ice, hence opening pathways for economic exploitation and development. This means that in addition to government interests in the region, private companies seek to conduct business operations, and environmental agencies seek to maintain the biodiversity in the region even though it is constantly changing. One of the great barriers to understanding these constant changes in the arctic ecosystem is the lack of consistent and regular long-term monitoring programs in most arctic marine regions, especially the unique and vulnerable ecosystems. A key reason might be

that the Arctic spans a wide range of environmental conditions in the extremes of temperature, salinity, light, and existence of sea ice (Conservation of Arctic Flora and Fauna, 2013).

In order to conduct successful operations in these regions, businesses need to fully understand the ecosystem of the area they operate in. Although the case study technology in this paper has been developed with research in mind, it may be able to facilitate such business operations by catering to interested third parties in this region. The topic aims to uncover the innovation space this research-based technology lies in as well as the commercial potential that can be achieved from research.

The historical function of universities serving purely as facilitators of basic research and as educators, initially for the elite, then for the public lasted as late as the 1980s in the US. However, with the enactment of the Bayh-Dole Act which enabled and facilitated the monetization of university research in the US, the general economy reaped great benefits (Mowery, Nelson, Sampat, & Ziedonis, 2001) (Litan, Mitchell, & Reedy, 2007). In Europe and the European Union, it is not that there are no Bay-Dole-like laws or acts put in place to bolster massive transfer of ideas and innovation from research institutions into the society and institutionalizing monetization practices, but rather, several countries within Europe have recently begun to see value in setting up "technology-transfer" departments, commercial exploitation policies and access to resources such as financial subsidies and innovation networks (Siepmann, 2004) (Clarysse, Wright, Lockett, Velde, & Vohora, 2005). This difference in approach might be due to the possibility that although the goals of taking technology to market are the same, the circumstances, incentives, and cultural backdrop are quite different (Nordfors, Sandred, & Wessner, 2003). Despite these facilitating factors, there is a reduced degree of mobility and interaction between the university and industry. This is partly because in the industry today, there is an increased competition from companies with low research and development costs and low-profit margins on the big companies with large R&D units such that these big companies are closing their research labs. The resulting effect of this is that there are reduced opportunities for researchers in academia to work in an industrial environment. In addition, there are insufficient incentives for the researcher to shift from academic work to business where they lack expertise. Also, complex policies with regards to factors like innovation, funding, and regulations amongst others are some of the problems faced when it comes to commercializing university research (VINNOVA / Swedish Agency for Innovation Systems, 2003) (Brown, 1985).

1.2 The Research Question

Brown (1985), states that research departments in universities play a central and substantial role in the areas of conducting research, educating engineers, scientists, and managers, as well as creating an environment for university-affiliated technology businesses to flourish. However, outside of this environment, university spin-offs usually start out as new ventures which have no reputation of their own. Brown further argues that some problems faced by universities when it comes to commercializing technology include risk aversion, lack of business experience and a wrong management structure. This is also confirmed by Fini et al. (2016) who also adds that spin-off creation is "rather new and unfamiliar" in Europe, therefore making it an extremely complex task involving many stakeholders from inside and outside the university environment. For example, there is a need for the presence of varied competencies to transform the research project into viable products and services. In addition, there is also a need to establish a customer base willing to pay for these products and services it provides. Furthermore, finance structures such as venture capitalists and other early stage investors need to be assured that the investment risk – if any – is worth it.

To aid the clearing of these problems, we posit the research question within this thesis as follows:

How then do we develop a positively successful business model centered on technology produced from research activity?

In order to answer this within the sphere of the case project, we have divided this research question into three sub-questions:

- *How* does this technology provide value to potential customers?
- *What* is the potential market for this value and *what* is the best strategy to enter this market?
- Which resources are needed for successful commercialization of the business idea and *why* should potential investors take the risk?

These sub-research questions make up the different chapters of the thesis.

1.3 Frameworks

The thesis has been developed using several academic, practical, and theoretical frameworks. The project is still very early stage; hence, we analyze its position within these frameworks using an idea evaluation approach. The innovation study aims to answer the sub-question

"how" - where we try to find the value provided to the potential customers. On the other hand, the market study aims to answer the "what" - where we find out the potential market and the best strategy to reach this market. We have strived to balance the academic and business aspects of the thesis to provide value to both the business community and the academic community. To do this, we divided the thesis into three parts – an innovation study, a market study, and a business plan.

1.3.1 Innovation Study

Research turns money into knowledge and innovation turns knowledge into money (Sætra, Innovation Study, 2016). This section of the thesis details an understanding of the technology without delving too much into technicalities to show where it belongs in the innovation framework. It is important to do this study because then we can build a capability to organize and manage our innovation, and how to turn this innovation into a strategic business advantage.

Innovation is an important driver of economic and social growth. It is a phenomenon as old as mankind itself and is such a broad concept that it encompasses a wide range of activities and processes (OECD/Eurostat, 2005). Innovation is an iterative process (Garcia & Calantone, 2002) involved the creation of a new or *significantly improved* product, service or process *combined* with the marketing or organizational method (OECD/Eurostat, 2005). Innovativeness, on the other hand, refers to the capacity of an innovation to create a paradigm shift or influence the resources and strategies existing in a firm (Garcia & Calantone, 2002). Not all innovation spaces are the same and depending on a point of view and approach to the new product development process, researchers, over the years, have ended up with the paradoxical creation of different typologies for same degrees of innovation and same typologies for differing degrees of innovation (Garcia & Calantone, 2002). For the purpose of this thesis, we have considered two innovation frameworks - the Four Quadrants of Innovation framework and the Doblin ten types of innovation.

When it comes to the innovation analysis based on product/service and the market, we consider it based on market impact and technological progress. Most researchers center around the framework developed in 1990 when innovation, classified only as incremental or radical was considered incomplete and misleading (Henderson & Clark, 1990).

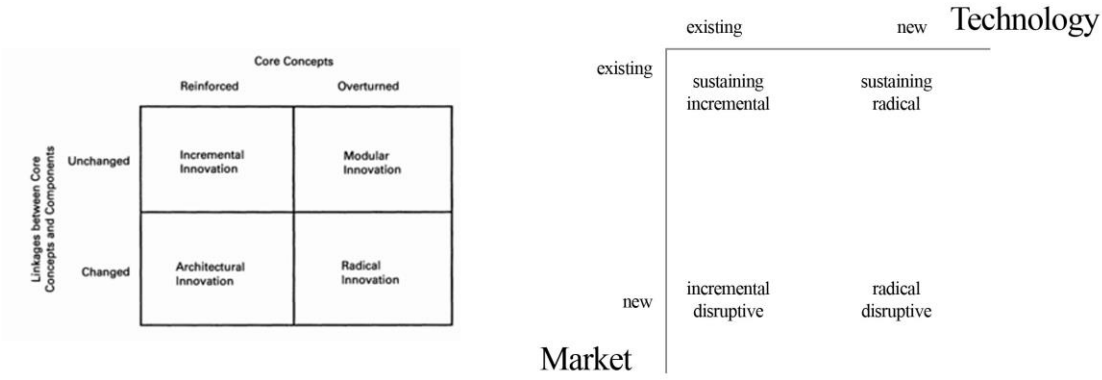


Figure 1: Henderson & Clark Framework (1990) and a modern perspective

Henderson & Clark studied the semiconductor industry and showed that classifying into incremental and radical did not account for large changes made in the market due to reinforcing an existing technology. Because of that, they introduced architectural and modular innovation. A much more general way of analyzing their framework is considering *core concepts* as *product/process/service which is either existing (reinforced) or new (overturned)* and the *linkages* as *markets which are unchanged (existing) or changes (new).* Also, reflecting upon Garcia & Calantone's statement that innovation involves an improved product, service or process combined with the marketing or organizational method, we discover that innovation studies and analyses cross between two axes – the *tangible* product or service offered by the business and the *intangible* organizational structures which might be the operational market or industry, the practices of the firm or the customer relationships and experiences. The presence of these axes presents a method of innovation analysis based on the *four quadrants or innovation matrix model* related to either market or process and technology paths.

Dewar and Dutton (1986) explain that radical and incremental describe different types of technological process innovations and these corresponds to the Four Quadrant axes. Incremental innovations are minor improvements or simple adjustments in current technology (Pelz, Munson, and Jenstrom, 1978; Dewar and Dutton, 1986) and are associated with existing product or process. The performance of an element can be significantly enhanced or upgraded, but the process is done steadily and incrementally. It usually involves the exploitation of existing technology and has low uncertainty. Incremental innovation sometimes implies improving competitiveness within current markets or industries. In contrast, radical innovations are fundamental changes that represent revolutionary changes (Dewar and Dutton, 1986). Radical innovation explores new technology, has high uncertainty, creates a significant

change that transforms existing markets or industries, and sometimes creates new ones. With regards to the market axis, the scale ranges from sustaining to disruptive innovation. Sustaining innovations are usually innovations that come from identifying and responding to the needs of customers in the existing market - in order words, they do not create new values or markets, hence the market is sustained albeit with a better product. However, disruptive innovations on this scale deal with the creation or capturing of new markets which are unknowable at the time the idea behind the technology was conceived (West, 2012) (Christensen, Raynor, & McDonald, 2015).

The Doblin 10 types' innovation model was set up as a diagnostic tool to access how a company approaches innovation internally (Sætra, Innovation Study, 2016). When innovation is discussed, it is usually based on the product. However, the innovation specialists at Deloitte say it is necessary to look beyond just new products to nine other powerful types of innovation, and combine them to gain a competitive advantage (Keeley, Walters, Pikkel, & Quinn, 2013). They are split into *configuration*, *offering* and *experience* as summarized in the table below.

Category	**Type**	**Integration of Innovation**
Configuration	Business/Profit Model	How the business makes money
	Networks and Alliances	How the business connects with others to create value
	Core and enabling processes	How the business uses signature or superior methods to operate
	Organizational Structure	How talents and assets are organized and aligned within the business
Offering	Product Performance	How the business develops distinguishing features and functionality
	Product System	How the business creates complementary products and services
Experience	Services	How the business supports and amplifies the value of its offerings
	Channel	How the business delivers its offerings to customers and users
	Brand	How the offerings and business are represented
	Customer Engagement	How the business fosters compelling interactions.

Table 1: Categories of innovation

One of the unique offerings of this business case is that it deals with innovation within the environment. We are in an era where we must manage resources rather than exhaust them. In line with this, the span of industries in the "firing line" from environmentalists and the general public has been increasing significantly since the 1970s (Elkington & Dimmock, 1992), as such, there has been a need for business ideas in the sustainable development space. The business case is based on an idea that contributes to making a difference in the world. Thus, it can be said to fall under sustainable business development (Alänge & Lundqvist, 2013). This is further confirmed in the UN Brundtland Commission's (1987) report where they state that "Sustainable development is one that meets the needs of the present without compromising the ability of future generations to meet their own needs". The business case is within their second key concept which is based on "the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs". Lundqvist (2013) proposes that the first stage of sustainable business development is the idea evaluation stage. There are various methods of evaluating a business idea to prove that it matches certain criteria. Business managers could use business idea evaluation checklists such as those created by Princeton Creative Research (Raudsepp, 1984) or the 21-point invention evaluation checklist (Entrepreneur Media, 2015). These, however, are simply general checklists and do not really identify key factors about the idea. From a financial point of view, the cost-benefit analysis method can be modified to weigh the possible direct, indirect, financial, and social costs and benefits of a certain idea to evaluate if it's worth pursuing. Mathematical models such as the Matrix Approach (Wind & Claycamp, 1976) or the AHP-based approach (Saaty, 2012) which both aid decision makers by scoring and rating criterion based on their given weights. These, however, are complex and lean toward theory rather than creativity and practicality. The Kepner Tregoe root cause analysis model (Kepner & Tregoe, 1965) is similar to the AHP-based approach, but this approach enables analysis with a high level of objectivity. Alternatively, ideas could be evaluated based on financial impact (cost-benefit analysis) or customer preference (Kano Model). In short, different methods could be used for assessing ideas based on the criteria to be evaluated.

To evaluate the business idea in this thesis, our criteria lie in the dimensions of novelty, workability, relevance, and specificity. Douglas et al (2006) summarized MacCrimmon and Wagner's (1994) definitions of these dimensions as follows:

- **Novelty**: an idea which nobody has expressed before.
- **Workability**: an idea that does not violate any known constraints and can be easily implemented.
- **Relevance**: an idea that satisfies the goals set by the problem solver.
- **Specificity**: an idea that is worked out in detail.

An approach which tackles the idea evaluation process in these dimensions is the "packaging approach" as proposed by Alänge & Lundqvist (2013). They note that this approach not only evaluates the viability of an idea but also identifies and expresses the potentials of that idea which in turn enables "not yet identified stakeholders to be attracted to the idea". This approach is suitable for sustainable business development cases because, in this field, customers do not need the products, but rather must purchase due to regulations or policies. If these policies do not gain ground or fail out in the nearest future, then customers do not see the need to continue supporting the business. Hence, extra key factors in this report would be valuable with regards to studying the market and attracting relevant stakeholders. The innovation study section outlines these key factors and places the business idea in its relevant innovation space.

1.3.2 Market Study

Innovation study and idea evaluation leads to the next step - studying the market to find a suitable strategy for entering the market and commercial development of the project. For this purpose, first of all, the analysis of the macro environment is needed, for which the PESTEL analysis (adopted from Aguilar (1967) framework) was used. It includes the overview of political, economic, social, technological, environmental and legal aspects of the macro environment, which gives the understanding of the market conditions, where the project is meant to operate.

The next step of the market study is competitor's analysis. For this step, the framework of a broad-based managerial approach to competitor identification and competitor analysis (Bergen & Petergraf, 2002) was used. This framework contains two stages. The first stage includes a broad-based approach to competitor identification, classifying candidate competitors on the basis of similarities in terms of their resource endowments and the market needs to be served. The main question of this stage is whether two firms serve the same customer need presently

or have the ability to do so in the near future. The aim of this stage of analysis is to maximize the awareness of competitive threats and to classify the types of competitors. In the second stage, an evaluative approach is taken to answer the question of how well two firms serve the same need or how their capabilities compare. The notion of resource equivalence is introduced on this stage to assess the strengths and weaknesses of the competition in terms of comparative capabilities.

The results revealed in the PESTEL and competitor's analyses lead to the next step that contains the internal analysis of the product using the frameworks of SWOT analysis. SWOT analysis is a method credited to Albert Humphrey, who led a convention at Stanford University in the 1960s and 1970s. Later the method was popularized at Stanford University. The SWOT analyses focus on assessing the strengths and weaknesses, which are often internal to organization, and opportunities and threats that are generally related to external factors. This is a useful tool for assessing the potential of the product for further development of the marketing strategy and business plan.

The last stage is the developing of the market strategy. For this purpose, the "Crossing the Chasm" strategy (Moore, 1999) was chosen. This strategy is created specifically for high-tech products such as a subject of the Master Thesis. The strategy based on the classic marketing concepts such as Product, Positioning, Price and Distribution, which are also the core elements of 4P and adopted 7P marketing model (McCarthy, 1960). However, the realization of these concepts is different from the classic marketing tools. One of the core elements of the crossing the chasm strategy is "The Whole Product", which suggest completing a core product with the maximum of possible additions. The concept is shown in the picture below.

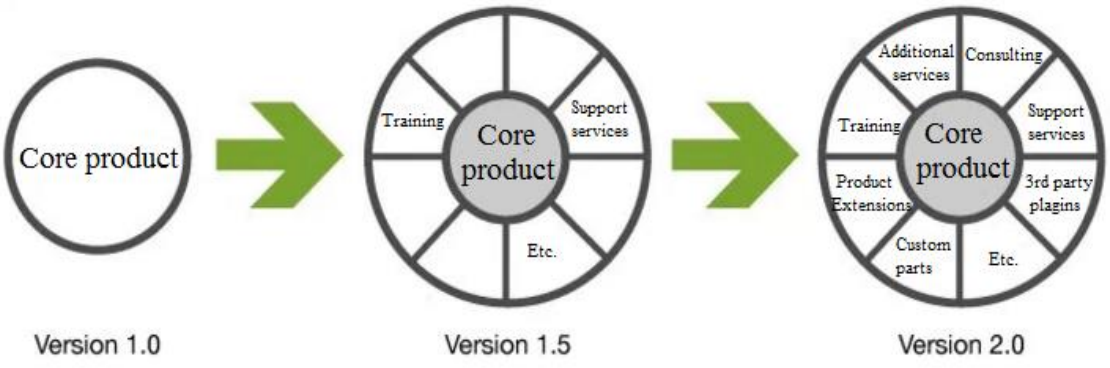


Figure 2: The process of evaluation to "The Whole Product" according to (Moore,1999) Crossing the chasm strategy (Nielson, 2014)

The positioning of the whole product is suggested by showcasing values such as market share, third party support, standards certification, application proliferation, vertical press coverage, industry analyst endorsements. The distribution channels have a critical role in Moore's framework. He argues that most distribution channels can fall into two general categories: *demand creators* and *demand fulfillers*. The most effective channel for new technologies is the direct sales, which meant to be optimized for demand creation. Unless the product category is well defined and well established in the market, it is necessary to have a direct sales force out in the market to explain the benefits of the product. Conversely, retail sales channels are optimized for demand fulfillment. (Nielson, 2014)

The core of the strategy is the chasm. It applies to the classic life cycle theory (Vernon , 1979), adopting it from the life stages of the product to the groups of users on each stage (Picture below). At the start, a product reaches the first group – innovators or enthusiast, who are interested in the newest things. Then it moves to the early adopters or visionaries, who appreciate the newest technology and can see its potential. After this point, the chasm appears. The main goal of the entire strategy is to cross the chasm between the innovators and early adopters to early majority and move to the late majority. For this purpose, Moore created three concepts, named "bowling alley", "tornado" and "the main street".

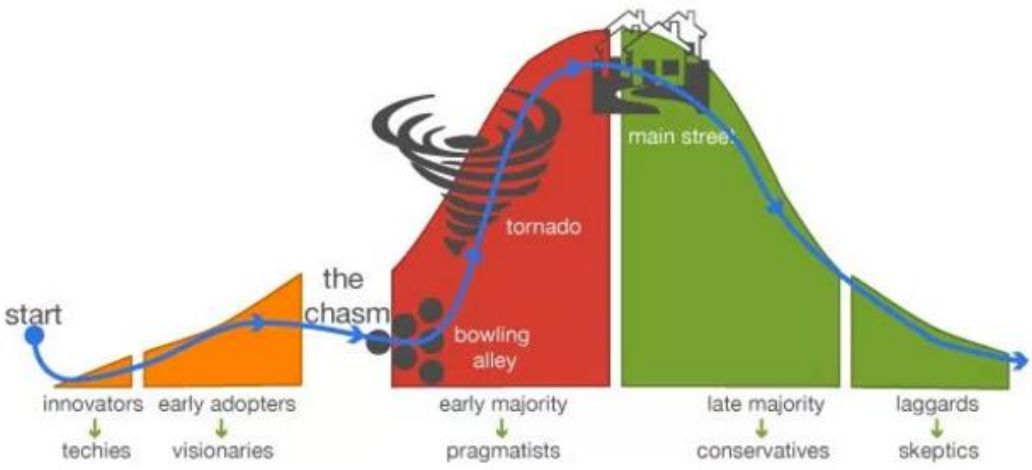


Figure 3: The crossing the chasm strategy (Moore, 2014) in terms of product life cycle (Nielson, 2014)

The *bowling alley* concept is created for market segmentation. However, the theory disputes narrow segmentation and niche marketing, accepting the possibility to reach several market segments. It suggests looking at the target markets like bowling pins. Identifying the lead pin is critical to knocking down the others. The main goal of this strategy is to create the set of

bowling pin target markets for the business. It can be the lead pin, the two and more pins. The strategy allows taking this down as many levels as it needed. Then it is necessary to make sure that the transitional plans and content are in place to move from one target market to the next. (Lieberman, 2012).

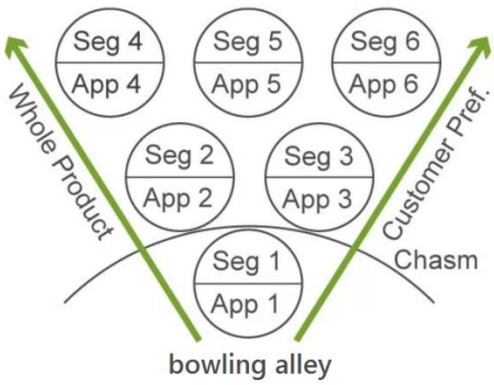


Figure 4: The bowling alley (Moore, 1999) by (Nielson, 2014)

The *tornado* is a time when the building of the whole product is completed, and the market demands the product. It's a time when a business needs to scale exponentially in order to keep up with potentially crushing demand. During this period, every effort within the organization should be devoted to providing the product as efficiently as possible. (Moore, 2004)

Coming out of the tornado to the *main street* is a period of relative calm for business. The whole product has been built and proven in the market. The opportunities for growth are limited in scale but high in margin. This is when building an aftermarket program becomes the next big opportunity in the life cycle. The biggest opportunity on this stage is to leverage a market position by providing what Moore calls +1 aftermarket add-ons that improve the functionality of your whole product and prevent customers from having a reason to switch to a competitor. (Nielson, 2014).

Moore's model is suitable for new innovative products that require the organization to create a new market or create a new demand on an existing market. The concepts of the whole product and the life cycle concept with its tools are relevant for the building the market strategy for the ICE-POPEs.

1.3.3 Business Plan

From a cross-cultural point of view, making plans reduces uncertainty (Hofstede, 1980) and provides meaning to a business. On the Geert-Hofstede tool, Norway scores a 50 out of 100 on the uncertainty avoidance scale as well as a 35 out of 100 on the long-term orientation scale

(itim International, 2017). This presents it as a normative culture where generalists and experts are needed. Plans are made, but can be altered and are open for improvisation to achieve quick results in the short term. In line with making these plans, this section of the thesis is an independent part of the paper and can be read as is. It is a "start-up" type business plan (Paige, 2010) and details the sections necessary to start and run the business. It includes parts from the innovation and market study and adds financial analysis and forecasts to determine income, profit and cash flow projections in the short term hence appealing to investors.

The business plan structure was developed to summarize key findings of innovation study and market study and build a presentable overview of the project and its potential.

Although the business plan is styled as a "start-up" type, it also includes feasibility studies and operational strategies to appeal internal parties. This would enable realistic, objective, and unemotional thoughts with regards to the business.

1.4 The Business Case

The Arctic is one of the world's life-sustaining and most fragile ecospheres. As human activity increases in this region comes the need for sustainable business practices. The business case supports sustainable business development by providing technology for the collection of data in the Arctic. This case study technology is the product of cooperation between the Norwegian University of Science and Technology (NTNU), UiT (Norway), The University Centre in Svalbard (UNIS) and Scottish Association for Marine Science (SAMS). The POPE system is an autonomous device capable of carrying out *physical and biological data measurements*, in and below sea ice, both in static and drift Arctic ice, *over complete year cycles*. The first POPE systems went on test field deployment in January 2017 and were successful, the full operations would commence from 2019. (Berge, et al., 2016).

The ICE-POPEs come with a variety of default sensors, however, sensors can be bought off the shelf and fitted on to perform a variety of data collection purposes. The business proposition stems from the idea that this technology can be used to gather a wide range of relevant data in the Arctic Circle and hence, can be adapted, customized and fitted to provide data and information for different relevant customers.

1.5 Methodology

Several methods have been used in this study, both for the purpose of data collection and for the purpose of analysis. These include a case study analysis, a field trip to Svalbard, interviews, and presentations.

1.5.1 Case study

To tackle the research question, we opted for a case study research method. Yin (2009) defines case study as "an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context especially when the boundaries between phenomenon and context are not clearly evident" (Yin, 2009). Amongst other things, the research question also cites the establishment of 'positively-successful' business models. How then can we know when a business model is 'positively-successful'? Is this a phenomenon or a context? What level do we measure the success on - the context of university research-based spin outs or that of the technology in its own space? These blurred lines skewed the choice of research method to case studies. This methodology is very useful in business research as uses triangulation to answer the questions of 'how', 'what' and 'why' in order to provide in-depth insight and allows multi-faceted exploration of the research questions in their natural real-life contexts (Dul & Hak, 2007) (Crowe, et al., 2011).

One of these challenges relevant to the research is a lack of business skills in the research environment. Many of research-based innovation had to be found by business developers, because researchers and scientists often do not see a business potential of their inventions, preferring to use their skills solely for scientific goals. Science is a field that needs full concentration, and researchers usually do not have time to find out that if their inventions can be commercialized. If they do see a business opportunity, they face challenges within legal *(intellectual property)*, market analysis *(segmentation and strategy)*, business propositions and financial planning *(venture creation and funding)*. It discourages them to commercialize their ideas, hence many inventions remain relatively unknown.

Nonetheless, facilities such as business incubators, innovation search companies as well as channels between universities faculties are meant to solve this problem. Collaboration between research and business facilities should be encouraged to aid turning innovative science-based projects into a successful business in the interests of all parties involved.

1.5.2 Data Sources

The idea used within this thesis was introduced to us by Professor Elin Oftedal as a project her colleague, Professor Jørgen Berge from the Arctic Marine Biology Department was working

on. Following this, we had to collect and review primary and secondary data about the case (Hox & Boeije, 2005). For primary data, we had a few interviews with Professor Jørgen and participated in the Underwater Robotics and Polar Night Biology course at the University Centre in Svalbard attending seminars and conducting some surveys with the students involved in the course and staff involved in the project, placing importance on the fact that they had varying backgrounds and competencies. The seminars which were analyzed were given by experts in robotics, technology, and biology. This experience provided a platform for a general technical overview and a good understanding of different types of underwater robots and the sensors that were installed on them. The theory with regards to the microbiology of the high Arctic were provided, and the global importance of the problems caused by increased human activities in this region were highlighted. Following this, was two-week testing of the product in actual environmental conditions *(on an artificial ice platform established in Ny-Ålesund and observed during the Polar night)*. The findings were that the product worked satisfactorily, and all currently researched hypotheses were proven. However, the technology is will still undergo future development, and new hypotheses and tests will still take place to uncover and discover new capabilities.

In addition to this, various academic theory behind ice-tethered platforms were explored to discover if the idea was as novel as it claimed. This would be further discussed in the novelty and freedom to operate section. We also considered theory behind the successful commercialization of spin-offs from university research under ordinary circumstances. These aims place our case study as a *typical case* (Cohen & Crabtree, 2006)**.**

1.5.3 Case Evaluation

To evaluate and test the practical nature of the case, we participated in academic springboards, arranged by UiT and Norrinova Technology Transfer AS. This is one of such facilities set up to aid students and inventors to obtain adequate business insight from industry experts with varying range of competencies, and depending on the stage and value of the invention, can also facilitate the provision of grants for entry into the market

The springboards were arranged in two rounds. In the first round, the project and the research findings were presented to the representatives of the relevant fields. The first advisor was Torbjorn Eltoft – a leader at the Centre for Integrated Remote Sensing and Forecasting for Arctic Operations – who has industrial experience in the field of arctic remote sensing technologies. The second advisor was Martin Skedsmo – a business developer from Norrinova

Technology Transfer AS – who has worked with the Arctic Council and has additional experience in selling mapping systems to the oil and gas industry. They provided some insight about the entry strategies for the oil and gas markets with the key players and profit providers being multinational companies like Royal Dutch Shell and Statoil. They recognized the potential in the business case and applauded the technology as quite innovative regardless of the fact that is still early stage. However, they did not believe that the technology can serve all industries as it claims to *(through the use of relevant sensors for relevant purposes)* and did not see it feasible to target a wide range of markets vis-à-vis targeting a specific niche market. Martin also gave some insight into the buying patterns of Statoil, citing that they are "very hard to sell to, except they really need your technology as a means of increasing their revenue or cutting extremely significant amount of costs". Their advice were very valuable and were taken into consideration for further development of the business case and the second round of the springboard. The second round was related to the business plan and was presented to Dagfinn Sætra, a lecturer at UiT and business developer at Norrinova Technology Transfer AS. He stressed the importance of showing financial values as accurately as possible. This is because potential investors *(board of directors)* need to see how revenue would look like during business operations in order to provide "serious funding" to enable these business operations. Due to the stage of the business as a startup, assumptions were made as reasonably as possible his advice was considered for the final development of the business plan.

To further evaluate the case, representatives of relevant industries were also interviewed. The Dutch company "Fugro", which provides geotechnical expertise for oil and gas companies, provided significant insight about the industry with regards to operating principles and costs related to consulting and outsourcing. We also interviewed a previous manager of Statoil AS who outlined some details regarding Statoil policies and budgets. These shed some light on the costs that target companies are willing to pay for the external services in different sectors, further confirming the previous insight from the springboard that oil companies are willing to pay for solutions and services that add significant value to their business operations.

1.6 Findings

During the course of the case, it was discovered that even though from the onset, the technology can provide solutions for a wide range of customers, the business would be both financially and physically demanding. The Market study defined a wide range of customers in different markets, which means a wide range of solutions have to be provided without flaw and delay. For example, if an oil company needs to measure and analyze the amount of pollutant released

by their operations into the ice within a time frame of 6 months and at the same time, a governmental organization needs to analyze the biological properties of an ice field in an area within 7 months. These projects might need different sensors but might also need similar competencies working on different projects simultaneously. This is a challenge which the business is not capable of tackling during its early phases and in order to scale through this challenge it is necessary to focus on just one market with potentially high-value customers. This showed that the even though the business case possesses a new technology and a knowledge-based competitive advantage that enables the offering of value-added products and services, it does not belong in the category of "born global" as stipulated by McKinsey & Co. (1993). It was discovered that due to the nature of the focus market and the key players involved in it, it is much more feasible to start small and then gradually expand as the technology develops to cater to more customers of varied needs within varied markets. These findings were taken into consideration when developing the market study

Another finding was that it is difficult for startups to get investments if they cannot show accurate financial projections due to the lack of financial activity to project from. This presents a sort of "Catch-22" which results in most startups seeking other means of funding their new ventures. The business case here is operating in a new space where ice-tethered platforms (currently used for pure research) are providing commercial value. This means that there is a very minimal trend in the market to project from within the market itself. To counteract the effect of this, and make assumptions as reasonably as we could, we took into consideration the current development of the project and similar markets to develop the business and financial plans.

1.7 Limitations

Case study research is time-consuming and needs extreme care to draw reasonable and feasible conclusions without running into the risk of generalizing (Dul & Hak, 2007)

There are certain limitations to the research. The first is the level of knowledge and information available relative to the length of time over which the study was carried out. Certain steps such as getting insight from particular representatives of the industry and governmental organizations were not realized due to the unavailability of these representatives to offer sound advice in a short term of five months during which this thesis was written.

Additionally, the background of the authors is in academic studies focused on business and information technologies. It limited their ability to understand the technical aspects of the

product; most of the technical insight was provided by the inventors of the product. Without a high level of scientific understanding, the science behind the invention could not be verified first hand. Some assumptions about general demand for the product and some general principles of work in the explored field are based upon interviews of the different relevant to the field of study experts. Despite the lack of technical knowledge and the desire to find the most optimistic way of product development, the authors made effort to make the research the most realistic and close to the situations in the study field.

The business case has its internal limits as well. The project is on development stage now, and will continue to be developed over the next four years *(up to 2020)*, hence reasonable assumptions have been made. These assumptions are made for the period when a company based on the project can be launched. However, the market situation can change dramatically in five years, hence skewing these assumptions towards a more theoretical character in long-term perspective.

Despite all limitations, this research aims to explore the possibilities surrounding commercialization of research in the university environment in theory, and to associate these possibilities with the current situation in the field of study.

1.8 Summary

In retrospect, the main finding of this thesis is that a scientific-based project can be turned into a business idea, and become a successful business that can serve global needs, including industrial and environmental. Particularly the ICE-POPE project has business potential and a market to step in. A current issue with the project is that it will take a long time for development and testing. Nonetheless, when development is done, there are good chances to become a profitable company, which can make significant input into industrial activities and global sustainable development.

2 Innovation Study

This section starts by first conducting idea evaluation using the packaging approach proposed by Alänge & Lundqvist (2013). Further on, it analyzes the technology and the business idea within two types of innovation concepts – The Four Quadrants Innovation Matrix and the Doblin Ten Types of Innovation framework. These approaches aim to answer the sub-research question "How does this technology provide value to potential customers?", hence discovering the customer utility potential of the product and business idea.

2.1 ICE-POPEs – New Technology for the Arctic

The Arctic Marine Biology department at UiT has collaborated with Scottish Association for Marine Science (SAMS, UK), the Norwegian University of Science and Technology and the University Centre in Svalbard (UNIS) to develop a unique solution for physical, biological, and biochemical data in the arctic sea ice. This new technology christened as the ICE-POPEs (Ice- tethered Platform cluster for Optical, Physical and Ecological sensors) can potentially be used for any applications that require the collection of data in harsh arctic conditions during the polar summer and winter.

The technology comprises six separate and autonomous drifting observatories with sensors, GPS and data transmitters with satellite communication abilities to allow real-time transfer of collected data and technical performance. It was developed based on a recently funded research proposal ("ArcticABC" project number 244319) with three different yet highly interlinked core modules:

- The Applied Technology module: this focuses on data acquisition and autonomous observations in areas and habitats which have not yet been systematically and scientifically explored.
- The Biological Interactions Module: this module is developed for answering a fundamental question of whether arctic marine ecosystems will be permanently altered following a continued reduction of the arctic ice cover.
- The consequences module: this will explore and forecast the potential consequences of reduced ice cover at increasing levels of complexity.

The project has developed the technology and it comes with specially developed optical, physical and bioacoustics data sensors with high degrees of sensitivity to provide a yearlong time series data. This technology was originally intended to be one physically connected unit

with all sensors in situ, however, upon further research and early development, the sensor packages have been separated into six different autonomous and independent units in order to enhance data transmission and reduce the risk of losing data. The sensor packages are divided into five ice-tethered observatory (ITO) units as listed below:

ITO 1: Sea ice mass balance buoy (SIMBA), designed to measure ice thickness, and based upon an existing system developed at SAMS. Also, it measures temperature in and below the sea ice.

ITO 2: Contains a string of temperature, irradiance, and salinity sensors to measure the water column close to the sea ice (within the upper 5,5 m below the sea ice).

ITO 3: This is the ecological platform. The main component is the Acoustic Zooplankton and Fish profiler, but include also a simple conductivity, temperature, and depth (CTD) sensor with light and Chlorophyll sensor.

ITO 4: This is the optical platform. Main components are the Underwater Hyperspectral Imager (UHI) with HD camera and a roll/tilt/compass sensor. A scalar irradiance sensor will be implemented if capacity (power and data transmission) allows.

ITO 5: An automatic meteorological observation platform with standard sensors, surface irradiance sensor and a 360-degree camera for weather observation.

ITO 6: A data storage and communication platform to collate data gathered in each of the other ITOs. Data will be harvested using drones and microsatellites.

Figure 5: The ICE-POPEs Station

The unique functionalities of these sensor packages are that in comparison with the current development in arctic sea ice research, the ITOs are fully autonomous and do not require recapture in order to harvest the collected data for analysis. In addition, they are fully sensitive for data measurement all year round – including the largely unstudied polar winter.

2.1.1 Novelty & Freedom to Operate Analysis

There are currently three types of ITOs in use today. These are the ice-tethered profilers (ITP) developed by the Woods Hole Oceanographic Institution, the ice-tethered moorings (ITM) developed by the University of Manitoba in Canada, and the arctic ocean flux buoy (AOFB) developed by the Naval Postgraduate School in California, USA. These systems are currently in operation, deployed in the arctic sea ice and is a basis for our novelty and freedom to operate analysis. The table below shows features of these ITOs in comparison with the ICE-POPEs.

	ICE-POPEs	ITP	ITM	AOFB
Real time data transfer	●	●		●
Ice Mass Balance	●	●	●	
Temperature Sensor	●	●		●
Salinity Measurements	●	●		●
Light and Irradiance Sensors	●	●		
Chlorophyll Sensors	●	●		
Acoustic Zooplankton and Fish Profiler	●			
Underwater Hyperspectral Imager	●			
Acoustic Doppler Current Profiler			●	●
Dissolved Oxygen Sensor		●		

** Available features are marked with the bullet point*

Table 2: Types of ice-tethered observatories (ITO)

One of the key advantages of the ICE-POPEs is that they can be fitted with sensors bought off the shelf to provide relevant measurements as needed. Hence, as seen in the table above, most of the sensors within the ICE-POPEs technology are not necessarily a new feature in the market. Also, the Underwater Hyperspectral Imager (developed by partnering lead scientist

Geir Johnsen and patent held by Ecotone), as well as the ice mass-balance (developed by partnering institution, SAMS, UK), are specially modified and integrated into the ICE-POPEs infrastructure in conjunction with their developing bodies.

As it was noted, the features and sensors within the ICE-POPE systems are not necessarily new, there is a class of invention wherein the novelty of this technology lies. This is the combination invention (Lemley, 2011), the novelty here resides in the combination that did not exist in prior art. Hence, the total working infrastructure as a combination of six drifting units, functioning autonomously and equipped with different sensors and profilers for acquiring biogeochemical data in real time, throughout the year, using drones and microsatellites for data harvesting and communication is novel. Upon determining the novelty of the technology behind the business idea when considered as a combination invention, we also proceed to determine the inventive step.

An invention can be considered to have an inventive step if the results of the combination invention are obvious to one with ordinary skill in the subject matter. The subject matter, in this case, is the provision of arctic sea ice monitoring platforms and the first step here would be to define the ordinary skilled person (Barton, 2003). The ordinary skilled person here would be an ordinary scientist. Reflecting upon the technological makeup of the infrastructure, this person would be able to combine those elements that make up the ICE-POPEs, hence there is no inventive step involved.

The technology described in the business case is not currently the intellectual property of any individual or body. The technology has already been published in scientific journals open for interested parties to access. In addition to other steps, gaining a patent requires that there is no published information about the technology in question. Also, although the technology has moved from purely research phase, it is still in development and testing, and open for further developments that can modify its features. However, the infrastructure is fully owned by UiT and has the responsibility to ensure operations and upgrades to the infrastructure after the ArcticABC project period has ended.

In line with the above, the business proposition behind this idea is that the technology developed in the ArcticABC project can be used to collect data/information for various third parties carrying out activities in the central arctic ocean. The project and the technology are developed by a team of specialists with varied competencies that can analyze the collected data to produce and report meaningful information for these interested third parties. The

infrastructure used in the technology is the intellectual property of the university and will be licensed out for commercial use.

2.2 Value Visions

Norway has a national vested interest in the Arctic with regards to the exploration, scientific survey, and management of arctic seas within Norwegian official high-north strategy. The construction of a new ice enforced national research vessel is in process to ensure that research and monitoring of polar marine systems can be conducted, thereby illustrating the national importance of scientific exploration and monitoring of the Arctic Ocean and ice covered waters. With human activity in the Arctic on the rise, this importance placed on this region affects public and private sectors alike.

The business aims to use the novel technological platform enabled by the ArcticABC project to provide crucial data that will significantly support scientific and industrial explorations, monitoring and management of the Central Arctic Ocean. Potential target end-users are partners in government (environmental agencies, policy makers, and authorities), industry (fisheries, aquaculture, oil and gas, underwater mining, transport and tourism) and environmental research organizations. The main goal is to grow the company and provide it with a valuable market and industry position by pioneering the development and application of real-time, multi-parameter observatories designed specifically with measuring key variables in vulnerable ecosystems, starting with a focus on the high stakes energy/oil sector doing business within the Arctic region and then steadily expanding to provide services to other industries as expertise and capabilities increase and technological gateways open. Furthermore, the business has an objective to provide special services such as consultation, technology solutions and human expertise to the industry as the market develops and industries increase.

2.2.1 Value Proposition (To Whom, For What & How)

With fisheries, oil and gas, and mineral extraction from the sea-floor expanding northwards, shipping routes passing through the north and previously ice-covered areas opening for explorations it is crucial to fill important knowledge gaps and obtain the best understanding of the arctic system as possible. User groups that will strongly benefit from a successful development and deployment of the ITOs include:

- **Government** in order to manage global environmental policies through access to data and knowledge regarding an ecosystem severely understudied.

- **Industry:** through combining the ITO with the SIMBA observatories that will provide vital information and validation for remote sensing of ice cover, thickness, and extent.

- **Research, Science and Education**: through a unique integration between technological (enabling technology) and biological world (applications) leading expertise.

- **Geopolitics** through a vital understanding of production regimes in arctic waters.

The business aims to reach businesses within these user groups through the development of a unique and innovative business model that would cater to a varying range of situations of use using in-house and external experts.

2.2.2 Identifying and Prioritizing Situations of Use

Figure 6: Situations of Use for the ICE-POPEs solution package

The business model utilizing the ICE-POPEs technology can be used in a diverse range of applications to serve a diverse range of customers. Situations of use are highlighted as follows:

- Arctic region research and provisional access to databases with data collected over time by the ICE-POPEs.
- Arctic data analysis through a unique and specialized network of human resources distributed through the ArcticABC project and its partnering institutions.
- Provision of custom reports to relevant industries within the private and public sectors.

- General human expertise and arctic operations consultancy with regards to the biological, physical and chemical processes in the Arctic region.
- Technological solutions and services relevant for operations in the Arctic region.

2.2.3 PAH – A Challenge for Oil and Gas Exploration

While the technology and that data it provides can be adapted for use in many such industrial functions within the Arctic regions, the business focus at the start is on the high-value private industry starting with oil and gas exploration businesses.

Before proceeding with business operations and projects, companies in the oil and gas sector need to give a thorough report on the environmental status in their proposed project location and the ecological habitat in the area. They cannot start operations if they cannot show that the environment in that area is stable and will not be harshly affected while they carry out their activities. One of the key factors plaguing oil and gas exploration businesses in the Arctic region is the effect of polycyclic aromatic hydrocarbons (PAH). These constituents of crude oil are classified as pollutants and have been recently found to affect the reducing numbers of polar cod found in the arctic ecosystem. In line with this, it is highly important that oil companies show that there is minimal PAH in the locations where they carry out their operations, hence contributing to reducing their environmental footprint.

One of the outstanding advantages of the ICE-POPEs technology is that it can be retrofitted with off the shelf sensors to provide a varying range of arctic data solutions. It is possible to fit sensors which can measure relevant biogeochemical compositions around the drilling platforms and locations. This can then document either no release or the effects of the release of chemicals into the water due to the course of drilling operations. Furthermore, in comparison with current technologies such as satellite observatories, the ICE-POPEs can provide data not only on the surface but also 3-dimensional data above and below the surface. This can provide the data and information needed by the oil and gas exploration companies to keep operations ongoing. Also, the technology can provide data that can be used to cross-analyze different processes within the operating environment hence showing the full picture of the effects of the business within the arctic ecosystem.

To obtain authorization and operational licenses and permits, these companies need to show that there is no bias or conflict of interest present when they submit their reports. This means that they need to expertise of external bodies to properly analyze and present their collected

data into meaningful and relevant reports and presentations. This is where the availability of human expertise within the ArcticABC project and its partnering institutions show their worth.

2.2.4 The Ideal First Customer

A business-to-business (B2B) approach was taken to approach the ideal first customers in target sector. Transnational companies doing business in the Arctic regions such as Statoil are potential customers in this sense. Statoil, being a Norwegian company with mostly Norwegian values is very involved in environmental issues and this technology and its associated projects provide value for them with regards to their environmental outlook while they conduct their business operations. Current developments in observing oil platforms and drilling project locations are bottom mounted observatories. However, these observatories are difficult to set up and operate in arctic waters, also, they cannot reach the surface to communicate, recover or deploy at other needed locations hence reducing their efficiency. This means that the business has the capability to provide an updated, more efficient, and less strenuous alternative than those currently in the market. Other potential customers will be further outlined in the market study.

2.2.5 Business with Society in Mind

As human activity in the Arctic increases, activity cycles expand from mostly polar summer operations to include the polar winter (black-box) operations. With the increase in activity cycles coupled with a piqued interest in climate change, there is a need to observe, analyze and report what happens in the Arctic. The business contributes positively to that need, hence enabling responses to the ecosystem and environment as needed. Many companies are involved in initiatives related to environmentally sustainable operations. As a societal utility, the focus is on Corporate Social Responsibility for these companies. By patronizing the business and using the associated technology, these industries fulfill part of their CSR towards a sustainable environment and environmentally friendly operations. Also, with regards to the ecosystem in the Arctic regions, the business contributes by ensuring these ecosystems are well monitored for eco-balance especially during the polar winter cycle when most of the organisms in the arctic ice move up in the water column towards human activity.

Through the influence of governmental bodies and legislation, companies in the relevant industries can be encouraged to adopt this technology in line with economic, ecological and social development.

2.2.6 Business Utility

The technology is currently undergoing test deployment and would be ready for industrial and market use from 2019. When development stage is completed, the business will be ready to provide solutions to customers willing to pay for the services. There is already a well-established network of human resources associated with the technology to support the provision of said solutions for future business. The extent of the idea as a business model is developed in the subsequent chapters.

The preceding evaluation of the idea shows that it holds the potential to carry on with the further commercialization of the technology and its associated projects when it is developed into a viable business model.

2.3 Innovation Analysis

As it was mentioned in the introduction, Garcia & Calantone (2002) noted that innovation is the creation of a new or significantly improved product or process combined with the marketing or organizational method. The existing and comparable technologies shown in Table 1 have their advantages and disadvantages and can be considered as inventions or innovative in their own spaces. For this business case, a significantly improved technology with the ability to create a paradigm shift has been researched and developed, therefore classifying it as an innovative technology on its way to becoming innovation. The following sections aim to place the technology and business idea into its relevant innovation spaces using the Four Quadrants model and the Doblin model.

2.3.1 Four Quadrants Model

The Four Quadrants of Innovation based on market and technology paths is a viable way for analyzing what made a business or a firm come up with a superior or entirely new product, service, or process. As noted by Henderson & Clark (1990), the quadrants are not rigid confinements for a given innovation. Innovations can be found in more than one quadrant depending on the viewpoint and can be freely considered as less of one and more of another. This suggests that placements in these quadrants are more subjective than objective.

It is also possible for a company to be found in multiple quadrants as they want to develop their innovation portfolio and hence start the process to a new product or service.

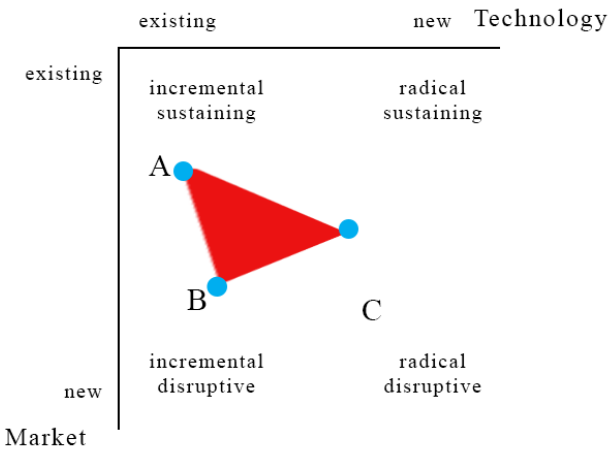


Figure 7:. Quadrants of Innovation

The business case belongs in different quadrants of innovation based on the perspective which is chosen to examine it from. It can be classified as "incremental sustaining" when it is considered from the perspective that the market and technology for already existing autonomous ice-tethered platforms exist. Ice-tethered platforms are currently the choice of preference for research facilities who prefer not to send out scientists to risky and costly expeditions. In this space, the ICE-POPEs add new features to the already existing technological system by introducing the ability to monitor biological processes in addition to physical processes all year round. On the other hand, it was observed that the project uses some existing technology to provide value to new markets opening up in the Arctic such as oil and gas exploration, fishing and transportation – it can be additionally put in the "incremental disruptive" space. Furthermore, it is considered that the projects implement some new technology such as drones and microsatellites to transmit collected data in real time as well as the ability to be fitted with different off the shelf sensors for multiple scenarios – it leans a bit towards "radical."

2.3.2 Doblin Innovation Model

The Doblin innovation model can be used to analyze the business idea itself rather than the case technology. In order to identify which of the ten types of innovation the idea belongs to, the business idea must be broken down to take into account the different categories of the Doblin framework. In line with this, the business idea can be restated in the following way: *provision of reliable and accurate data using arctic ice monitoring technologies to interested parties doing business operations in the Arctic.*

The business idea aims to provide relevant data to an extended number of parties from oil and gas exploration companies to fishery companies. This greatly innovates the business model centered on ice-tethered platforms. In addition, the wide range of connections affiliated with the project means that the network capability is almost limitless. From arctic biology experts to arctic technology gurus, the collaborations within the project means that it can provide services to parties from a wide range of business services. In retrospect, the business idea can be placed under the *profit model* and *network* innovation.

To make this business configuration possible, the offering is to provide a service with the aid of distinguishing features in the arctic ice monitoring technology. The technology has been developed in such a way that it is capable of gathering data all year round, can provide biological data measurements, hence, the innovation here centers around the *product offering*.

In order to innovate on the elements, the customer is in touch with, the innovation lies in the *channel* by which customers can patronize the business. Due to the fact that the goal is to ensure that users can buy what they want, when and how they want it, the business aims to provide customers with a business experience where they get results and reports custom tailored to fit their operational needs and within all logistical restraints.

2.4 Innovating Further

With the Doblin framework as a base, we have postulated that the business proposition should be innovated around the profit model, network, product offering and customer channel. To do this, we chose to use the Moore (1999) strategy to innovate around the current value of the technology.

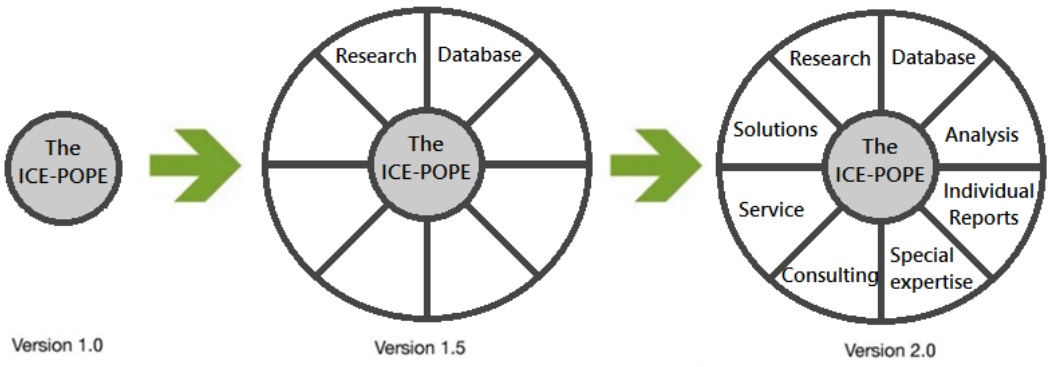


Figure 8: Product development according to (Moore, 1999)

Version 1 presents core version of the technology as it currently is. It has not been fully utilized for research and is mostly undergoing tests and further development. Version 1.5 is proposed

for the second stage of the ArcticABC project – where it would be used solely for research purposes. It has been slightly innovated around the product offering such that in addition to the main research and analysis, there is also a database to enable the storage, recall, and comparison of previously collected data. A practical example would be if current measurements see a decline in ecological organisms might be related to a change in ice thickness along the monitored route, due to the presence of the database, it would be possible to recall the historical ice thickness in the region to see the trend even though the ice was only measured for use on a project on salinity. By version 2.0, the technology and the business are ready to be introduced to the market and we notice that the product offering has been adequately innovated to provide more value to the target market. The benefits of innovating around the product model are endless especially with regards to scalability as custom-tailored analysis and individual reports can now be provided to potential customers. This, in turn, brings in the opportunity to innovate around the profit model where in order to carry out these analyses and produce these reports, we also initiate the payment of leasing fees for the use of the technology on the contracted project. In another scope, innovating around the network would mean the introduction of new expertise and competence into the business in one way or the other. From marine biologists, engineers and geologists to admiralty lawyers and experts on the Law of the Sea, innovating the network associated with the business adds value to the business by increasing the pool of human resources that can be assigned to the increasing range of product offerings. This also enables the provision of consulting services and special expertise as part of the profit model. To innovate the elements the customer is in touch with, special services and solutions which the customer can personally relate to can be enabled. However, to adequately reach this customer, we need to study the market.

3 Market Study

The subject of this Master Thesis – the ArcticABC project with a core of ICE-POPEs Stations - belongs to a group of research organizations with a scientific goal relating to biological and technological fields targeting the Arctic region. However, it is getting extremely important to consider science as a main power of economic progress to ensure sustainable exploration and development of the Arctic. Therefore, the market study claims to explore the ways in which a research project can become an independent provider of information, data, and resources to operate in the Arctic by taking into account first of all environment safety, climate conditions and future sustainability.

The purpose of the market study is to explore the current situation on the market of arctic resources, its main players on all levels and their activities, define the potential users of the product of the research project and find the way to collaborate by creating a marketing strategy and then building the business model. The Crossing the Chasm (Moore, 1999) framework was chosen for building a strategy for a company that will potentially use the ICE-POPE technology. This framework is relevant for the companies who already have early adopters (scientists and researchers in our case), and want to introduce the product to the market by crossing the chasm and the strategy is also relevant for the companies who claim to reach more than one market segment.

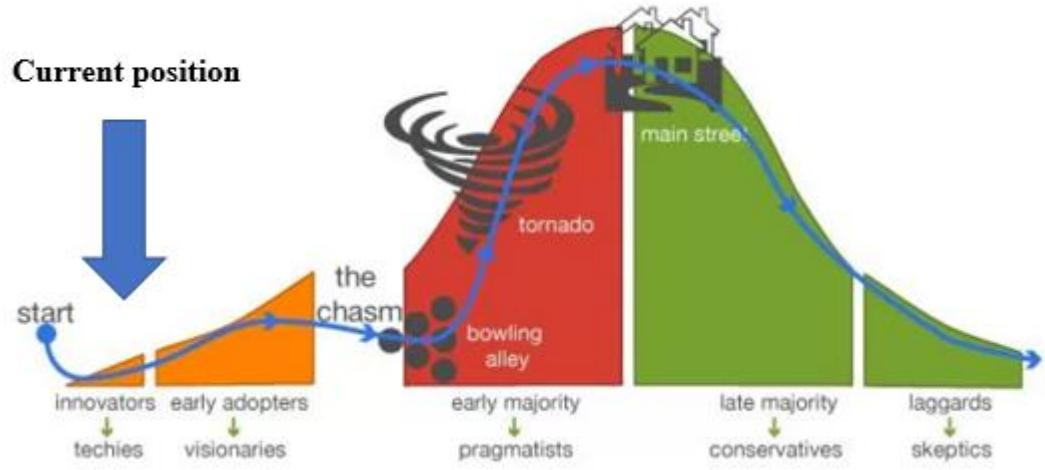


Figure 9: Crossing the chasm strategy (Moore, 1999)

To build the strategy using crossing the chasm, the potential market needs to be explored in detail. For this purpose, the Market study contains: market overview, market analysis via the PESTEL analysis, the market segmentation, defining target groups of the potential customers,

and competitor's analysis. Then the internal potential of ICE-POPE is explored via a SWOT analysis, and all results are used to create the marketing strategy and business model.

3.1 Market Overview

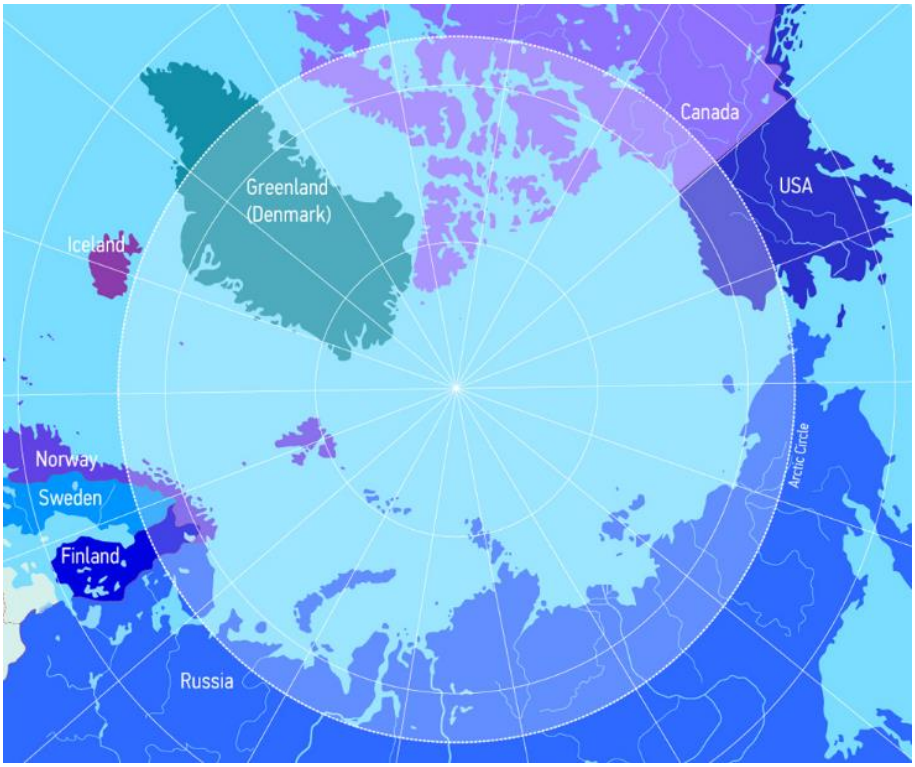


Figure 10: The Arctic geography (http://arctic.ru/geographics/)

The Arctic is a polar region located at the northernmost part of Earth. The Arctic consists of the Arctic Ocean, adjacent seas, and parts of Alaska (United States), Canada, Finland, Greenland (Denmark), Iceland, Norway, Russia, and Sweden, as it is shown in the picture above.

The Arctic occupies one of the most prioritized places on the global agenda; its geopolitical and economic role in the world is continuously growing. Long-term interests of many countries are connected with the Arctic region. At the beginning of the new century, the prospects for the development of the region were determined, and investment resources for the implementation of large-scale Arctic programs appeared. Huge natural resources, potential resources of oil and gas, as well as transit opportunities, makes the control of the circumpolar region a geopolitical priority for many states of the modern world.

Since the beginning of the 21st century, the changes taking place in the Arctic have had global implications for the world economy and politics. That is why the Arctic is one of the points of bifurcation in the development of the global world. The way development takes place in the

Arctic region, the world integration tendencies, the priorities of the main subjects of the world economy and the policies playing the dominant role in the polar region will have a global meaning and huge consequences for the future.

At the end of the 20th century, the tension in relations between the countries of the Cold War era gave way to the desire for international and regional cooperation. Where earlier geopolitics and the issues of national security dominated in the Arctic, now economic and humanitarian problems have come to the fore. This trend is expressed in cooperation in the field of environmental protection, indigenous peoples' affairs, as well as in scientific research, etc. The changing relationship between the Arctic and the outside world is due to the fact that the strategic military role of the region has been supplemented by its strategic role in the global economy, the richness of natural resources and the formation of international integrated transport corridors. The economy of the North is increasingly integrated into the global world system, and the importance of the Arctic is growing due to the expansion of demand for strategic minerals, oil, and gas, with increased interest in the region of transnational consortia, as well as the development of technologies that facilitate access to sources of raw materials. Integration in the creation of modern infrastructure is largely governed by national programs that involve the involvement of transnational corporations. (Mazur, 2010)

In the processes of globalization and solving problems related to the sovereignty of states, establishing their jurisdiction over natural resources and transport routes, as well as the regime of military-strategic presence in the Arctic, an active role is played by:

Arctic states	Governments, parliaments and state institutions of Russia, Norway, Denmark, Canada, USA, Iceland, Sweden, and Finland.
Intergovernmental organizations	The Arctic Council, the Barents Euro-Arctic Council, the Council of the Baltic Sea States, the Northern Council and the Council of Ministers of the Nordic countries.
International non-governmental organizations	The Arctic Council of Athabaskans, the Arctic Leaders' Summit, International Greenpeace, International Committee for Arctic Sciences, International Federation of Red Cross and Red Crescent Societies, Inuit Circumpolar Conference, Northern Forum, Northern Research Forum, Saami Council, Association of Winter Cities, etc.
Administrations of the Arctic regions	Provinces, districts, and municipalities; Organizations of indigenous peoples and non-governmental organizations of individual countries.

Non-Arctic states	The EU, Eastern European and Asian countries who are interested in the Arctic development in terms of national perspectives and global meaning.
International corporations	Mining, oil and gas, transport, telecommunications, etc.
Research organizations	International research organizations, universities, etc.

Table 3: Players in the Arctic (Mazur, 2010)

In the context of the Arctic development the above organizations have the following roles and interests:

The Arctic states make decisions about activities on its arctic territories, including granting permission to operate in the Arctic regions to local, foreign and international organizations. Arctic states are also responsible for providing legislative basis for all activities in the Arctic region. The Arctic states play the main decision-making role for all activities in the Arctic. For the further understanding of the market situation, it is necessary to explore political aspects and regulations of each Arctic state.

The Interstate organizations are called upon to ensure cooperation between the countries in the Arctic region. Thus, the Arctic Council claims to promote cooperation, coordination and interaction among the Arctic States, Arctic indigenous communities and other arctic inhabitants on common arctic issues, in particular on issues of sustainable development and environmental protection in the Arctic. (The Arctic Council, 2017)

The main task of *international non-governmental organizations* is to ensure the safe exploration and development of the Arctic region, protect the nature of the Arctic, and prevent damage to the global climate. For instance, the Arctic Leaders' Summit claims to provide a means for promoting cooperation, coordination and interaction among the Arctic states, with the involvement of the Arctic indigenous communities and other arctic inhabitants on common issues, in particular issues of sustainable development and environmental protection in the Arctic, oversee and coordinate arctic activities, sustainable development programs, disseminate information, encourage education and promote interest in arctic-related issues. (The Arctic Athabaskan Council, 2017)

Regional organizations ensure and defend the rights and further the interests of local folks.

Non-Arctic states - some of these have a longstanding involvement in the Arctic, but broader interest is also growing, significantly because of the remarkable decline of sea ice. The North's vast natural resources, potentially lucrative shipping routes and the visible effect of climate change all have an intense impact on the lives of those who call this region home while at the same time being of global interest. Whenever jostling begins in unfamiliar territory there is potential for sensitivities to be aroused and suspicions awakened; in the case of the Arctic, the risks are heightened on account of the relative speed with which developments are taking place. (Canadian International Council, 2011)

National and transnational corporations are interested in potential commercial opportunities of the Arctic development. A 2008 United States Geological Survey estimates that areas north of the Arctic Circle have 90 billion barrels of undiscovered, technically recoverable oil (and 44 billion barrels of natural gas liquids) in 25 geologically defined areas thought to have the potential for petroleum. This represents 13% of the undiscovered oil in the world. (USGS, 2008)

Research organizations make a scientific input in the Arctic development providing scientific data to the global community and helping all mentioned organizations to find sustainable ways of Arctic exploration and development.

Due to the increased accessibility of the Arctic region and its resources, a trend driving social and economic change in the Arctic region is its increased economic prospects. Global environmental prospects consider the Arctic as a source of scientific research on climate change, marine species and global warming. Ice melting makes the Arctic a potential territory for new shipping routes that may be promising in the future for all countries with export economies and can improve shipping of natural resources, which are the main interest of the global Arctic development. Besides all perspectives of the Arctic development, first of all, the Arctic is considered as storage of the North's vast natural resources.

3.2 Market Focus: The Arctic as an Energy Source

Plenty of researchers show constant growth of global energy demand and predict a continuation of this growth. This is due to the high level of consumption of developed countries and at the same time intensive development of such countries as China, India, and South Asia.

The Arctic Frontiers Forum 2015 predicted the significant growth of the energy demand of these regions by 2035:

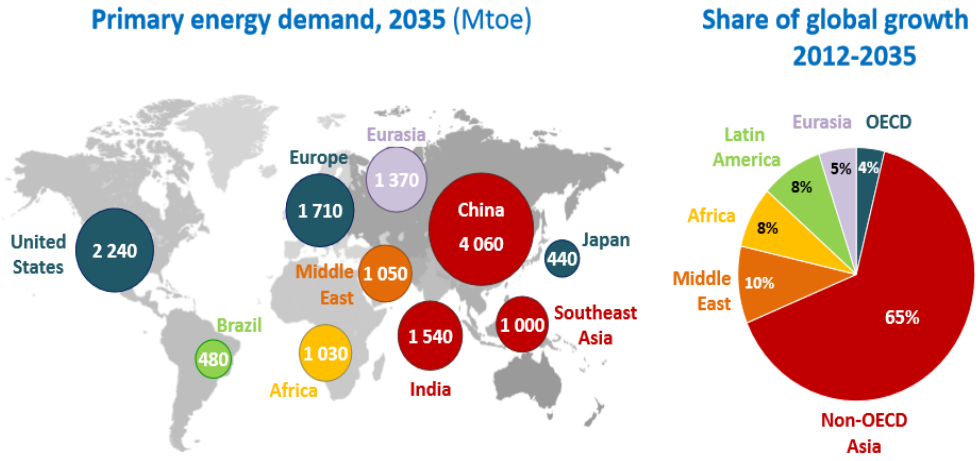


Figure 11: Global energy demand (Unander, The Research Council of Norway, 2015)

At the same time, a huge part of the world is still far from the modern development level. 1,3 billion people in the world live without electricity (Norwegian Research Council, 2015). The world global goal is to provide energy sources to low-developed regions. All these facts lead to the conclusion that the world demand for energy in the next decades will constantly grow.

Arctic Frontiers Forum 2015 presented various scenarios of future resource management. However, the realization of all possible solutions for decreasing energy wasting still shows a growth of energy demand in all possible scenarios.

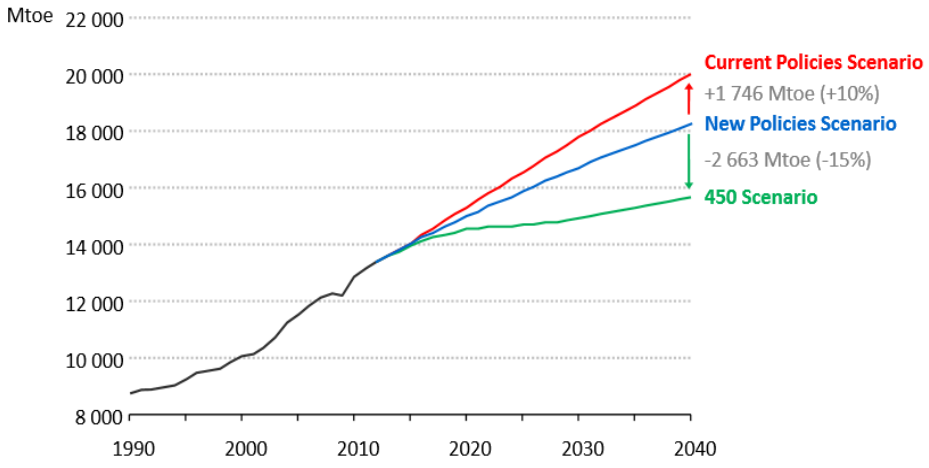


Figure 12: World total primary energy demand (Unander, The Research Council of Norway, 2015)

The above graph shows a clear vision that the main global interest of the Arctic development is its resources. The constant growth of the global energy demand drives the industry of hydrocarbons (oil and gas). Oil and gas companies run many projects of Arctic exploration,

actively looking for new technological possibilities for their activities in arctic conditions. That is why the oil and gas industry can be considered as the main actor who runs activities in the Arctic. All stakeholders and actors listed above are involved in the process of arctic resource development. That makes them potential users of the ICE-POPE since all these organizations carry out activities in the Arctic and potentially need arctic expertise. Further PESTEL analysis and market segmentation are designed to explore the potential of each group as the ICE-POPE user.

3.3 PESTEL Analysis

Political, economic, social, technological, environmental and legal aspects of the Arctic development and the meaning of these aspects for the ICE-POPE project.

The market overview showed all current players in the Arctic. For the purpose of market research, it is necessary to divide the concepts of the Arctic as a globally significant geographic area and the Arctic as a potential source market where all the listed players will operate to extract particular benefits. The PESTEL analysis will give an overview of the market environment, where the ICE-POPE will operate as a product.

3.3.1 Political Aspects of the Artic Development

First of all, it is necessary to understand political aspects of the Arctic as an area and as a potential market. Geo-politically the Arctic consists of land, internal waters, territorial seas, exclusive economic zones (EEZs) and high seas. All land, internal waters, territorial seas and EEZs in the Arctic are under the jurisdiction of one of the eight Arctic states: Canada, Norway, Russia, Denmark (via Greenland), United States, Iceland, Sweden, and Finland. All these countries have rights to operate on their Arctic territories, to conduct research and exploration and dispose of the resources found on their territories. For these purposes, the Arctic states are allowed to give licenses to national and international organizations for research, exploration, and extraction of the resources.

The Arctic region is also under control of the interstate organizations whose role is build cooperation between Arctic states, control the way the Arctic develops, ensure its sustainability, protect the environment and prevent any risks through the analysis of the Arctic potential and possible activities there, regulation and limitation of the activities through the dialogue with the states' governments. These organizations, such as the Arctic Council, observe all arctic activities as well as state Arctic policies and strategies for the purpose of controlling the Arctic development and lead it in the best possible way.

Review of the states' Arctic policies will give an understanding of the main principles of operations in the Arctic and help to define the way of involving the ICE-POPE in the arctic activities.

3.2.1.1. Canada

Despite the fact that the Arctic is becoming increasingly important in the global development, some countries adhere to caution and consistency of action, taking into account the aspects of safety and sustainability first of all. The Canadian Government has established a comprehensive Northern Strategy and is taking concrete action in four priority areas thus; "Exercising our arctic sovereignty, Protecting the environmental heritage, Promoting the social and economic development, Improving and devolving Northern governance".

3.2.1.2. USA

The USA Government claims to pursue the following lines of effort and supporting objectives in a mutually reinforcing manner that incorporates the broad range of U.S. current activities and interests in the Arctic region, in order to meet the challenges and opportunities in the Arctic region, and in furtherance of established Arctic Region Policy: Advance United States Security Interests, Pursue Responsible Arctic Region Stewardship, Strengthen International Cooperation.

Following their arctic strategies, USA and Canada made the following decision. At the end of 2016 US President Barack Obama banned the extraction of oil and gas in the vast areas of the Arctic and the Atlantic. That was reported on the website of the White House. It is noted that this US ban was introduced in conjunction with the Canadian authorities. The White House statement says that the United States has identified the vast majority of its territory in the Pacific and Atlantic Oceans as forbidden zones. In turn, Canada will make oil and gas production inadmissible in all of its Arctic waters. (The White House - President Barack Obama, 2016)

UPD, June 2017: At the moment of the presentation of this research (June 2017), the decision of Barack Obama will be officially overturned by current US President Donald Trump; US activities in the Arctic will start again.

3.2.1.3. Scandinavia

Scandinavian countries such as Sweden, Finland, and Iceland give the highest priority to the Climate and the environment (Sweden), Sustainable development and environmental consideration (Finland), the human dimension (Sweden), and arctic expertise. National governments consider economic development and international collaboration as well (The Arctic Portal, 2017). Currently these countries do not give licenses for industrial exploration in the Arctic, however, Iceland still has valid licenses that have been issued in previous years (Icelandic National Energy Authority (Orkustonfun), 2017).

The same principles are followed by the Danish government including the Greenland government. However, Greenland has actively awarded oil and gas exploration licenses since 2010 (Government of Greenland, 2010).

The Norwegian government, according to their Arctic policy gives priority to the following five areas: International cooperation, Business development, Knowledge development, Infrastructure, Environmental protection and emergency preparedness (Norwegian Ministry of Foreign Affairs, 2014).

3.2.1.4. Russia

The ultimate objective of the Russian state policy is to transform the Arctic into “Russia's foremost strategic base for natural resources” by 2020. One of the main goals of the Arctic policy is to increase extraction of the natural resources in the region. The Russian Arctic strategy clearly emphasizes the region's importance to the national economy as a major source of revenue, mainly from energy production and profitable maritime transport (Russian Ministry of Economic development, 2014).

3.3.2 Drilling in the Arctic

In May 2016 The US and five Nordic states (Norway, Denmark, Sweden, Iceland, and Finland) made an agreement to take a “precautionary approach” to oil and gas drilling in the Arctic. A joint statement emphasized their commitment to international climate goals, which analysts warn are incompatible with costly Arctic exploration. Following a similar commitment by Canada in April, it leaves Russia as the only Arctic nation not signed up to science-based standards (Darby, 2016).

However, in 2016, Norway announced a new licensing round for Arctic blocks and Russia is constantly carrying out activities in the Arctic.

The reason why Norway and Russia demonstrate different policies regarding the development of the Arctic is due to the direct dependence of their economies on oil production. Therefore, the economic aspects of the arctic activities must be explored as well.

3.3.3 Economic Aspects of the Arctic Development

For the Arctic states the petroleum industry is one of the main sources of the state revenue. All states receive substantial income from the petroleum activities. Tax from the production companies and direct ownership ensures that the States receive a share of the values created by the petroleum activities. As it was mentioned above, Norwegian and Russian economies are the most dependent on oil production. The petroleum sector had a 27% share of the Russian state revenues in 2013 (Hellevig, 2016). In Norway, petroleum activities contributed to 26% of the state revenue in 2010. In 2016, it decreased to 13% which is still a significant share of the state revenues. The significant input to the state revenue is provided by the petroleum taxation system. It is based on the rules for ordinary company taxation. Because of the extraordinary returns on the production of petroleum resources, the oil companies are subject to an additional special tax. In 2017, the ordinary company tax rate is 24% and the special tax rate is 54%. This gives a marginal tax rate of 78%. In 2016, Norway's estimated tax revenues from petroleum activities are about NOK 42 billion (2017) (Norwegian Petroleum Directorate, 2017).

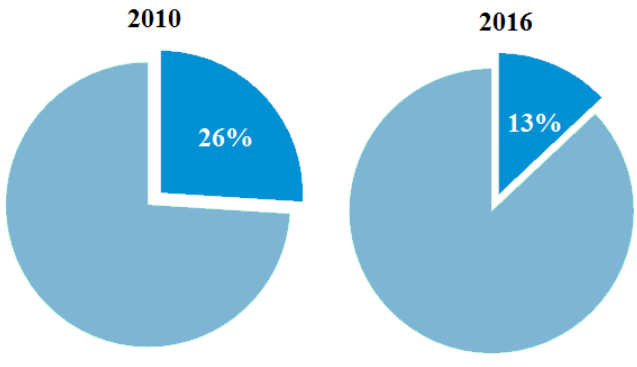


Figure 13: The Norwegian petroleum sector's share of state revenues (Statistics Norway, Ministry of Finance)

In 2017 Norway gave thirteen arctic drilling licenses to oil companies (Norwegian Petroleum Directorate, 2017). This suggests the re-growth of the petroleum sector's share of the state revenue.

The above information gives the conclusion that the development of the oil industry is necessary for state economic growth for the countries with petroleum dependent economics. Specifically for Norway, the development of the Arctic will play a significant role in future

economic development. The Norwegian government shows interest and encourages activities in the Arctic, and has a course for the growth of these activities. For the ICE-POPE it makes a positive environment for the entrance to the market and further operating.

3.3.4 Social Aspect of the Arctic Development

Social aspects in PESTEL analyses means the socio-economic environment such as demographic and cultural factors of the market. Since ICE-POPE is not meant to work with individual consumers, these aspects are not directly relevant to the case. However, social awareness and attention can be considered as a social aspect for ICE-POPE. Along with the growing attention to the arctic economic and resource potential, there is a growing social interest in the development of the Arctic. It increases the importance of carrying out the activities in the Arctic showing sustainability together with social and environmental responsibility. In recent years, the number of people involved in the environmental organizations (directly or by donations) increased dramatically. Greenpeace reports 42 million followers and supporters reached in 2015 all over the world, over 36000 active volunteers globally and regular donations, and gifts and legacies received from 3,3 million supporters worldwide. It also reports significant growth of the activities on social media Greenpeace resources presented below (Greenpeace International Annual Report, 2015)

Figure 14: Greenpeace social media – Key performance indicators.
(Greenpeace International Annual report, 2015)

The continuous growth of people interest and social involvement in the environmental issues obliges states and industrial companies to a responsible approach to their activities that would demonstrate sustainability and social and environmental responsibility.

Moreover, some industrial companies which belong to the states represent the state international image. For instance, Statoil is the representative face of Norway and its activities

can influence the reputation of Norway on the international arena as well as Norwegian government actions.

At the same time, the Norwegian government takes a unique social responsibility by building the Government Pension Fund. Its purpose is to facilitate government savings to finance rising public pension expenditures and support long-term considerations in the spending of government petroleum revenues. A sound long-term management of the Fund contributes to intergenerational equity, by allowing both current and future generations to benefit from the petroleum revenues (Norwegian Ministry of Finance, 2017).

The growth of media sources and social networks makes the activities of the state and industrial companies open to the public. Moreover, with the modern tools society can influence this activity, especially when it comes to globally significant areas such as the Arctic. Therefore, all players in the Arctic constantly need to demonstrate the openness of their actions and responsible approach towards the environment and society. It means that both government and industrial companies are willing to use all possible tools to prove the sustainability of their actions. That gives a social meaning to the ICE-POPE as a tool of sustainable development of the Arctic.

3.3.5 Technological Aspects of the Arctic Development

Developing oil and gas in the deepwater and Arctic frontiers is a major technological challenge. The severe environments – arctic cold, deep water, tough climate – and remote locations require the design and construction of innovative and costly exploration and production systems. The key to safe, efficient, and economic development of the Arctic is the technology used for exploring, producing and transporting oil and gas under some extreme environmental conditions (Washington, DC, 1985).

At the same time, it is important to have a wide overview of the activities in the Arctic and its consequences. The focus of exploration and its influence should not be focused on a particularly narrow area of the actual actions but explore its global influence in a long-term perspective. For the timely identification of changes in microenvironments capable of affecting the microenvironment, a deep expert analysis is needed. For this purpose, the innovative projects that can analyze various criteria of environmental changes will serve. A project such as the ICE-POPE is new to the industry, and its unique ability to analyze and retrieve environmental data even under the arctic ice may give it a market advantage and cause market demand. The existing technologies will be reviewed in the competitor's analysis below.

The necessary technological, infrastructural and operational improvements for successfully moving offshore operations to the Arctic require the collaboration of the different stakeholders. In order to make arctic operations feasible, there is a need for higher cooperation between arctic actors involved in the process. A global technological goal in the Arctic development is to identify innovative scientific and technological solutions to the Arctic development ensuring its overall and global safety and sustainability.

3.3.6 Environmental Aspects of the Arctic Development

The environmental aspect is one of the most important in the Arctic development. The problems relevant to the environmental aspects are under constant supervision of non-governmental organizations such as Greenpeace, WWF, etc. International non-governmental organizations have less legal power than state councils do, but they still have a significant role in the Arctic development. They are focused less on the economic potential but more on the environment and climate issues. Their mission is to build social awareness about the Arctic and global activities there to prevent the risks using society's power. There have been many cases when, for instance, Greenpeace global protests made oil companies pay attention to the environmental issues and correct their strategies. In 2015, Shell abandoned its arctic oil drilling operations after numerous protests and public resonance around the world under the auspices of Greenpeace (Glaser, 2015).

Obviously, there are many factors that influence companies' decisions. However, non-governmental organizations initiate a significant percentage of litigation about oil companies' activities, some of which lead to decisions in favor of the environment. These companies are not commercial; however, they have huge capitals built by social donations to operate against environmental pollution. For this purpose, they hire independent researchers and analytical companies to have scientific evidence against dangerous activities. Against the oil industry, independent research companies make reports such as maps of possible oil spills, flora and fauna analysis in particular zones, analysis of environmental changes in zones of industrial activities, water quality, animal population and many others. The Greenpeace financial report shows that every year the organization spends approximately 8,5 million euros just for the "Save the Arctic" project, 10 million euro for the Ocean programs and 25-28 million euros for Climate & Energy Programs (Greenpeace International Annual Report, 2015).

Moreover, not all problems seem to be obvious for government and industry. For instance, oil spills damage environment immediately and cause global social, economic and political

resonance, while things such as the PAH level influence environment slowly and less visible. However, it must not diminish the importance of the problem.

It means that the need for the arctic environmental expertise exists and is constantly increasing, and such projects as the ICE-POPE are needed for the global goal to protect the environment. The constant growth of the global ecological awareness creates a positive environment for the ICE-POPE development. However, awareness is not enough to change the course of action in the Arctic. Not all states and industrial companies are eager to take care of the environment if it goes against their commercial interest. The environmental care must be regulated by law. The current legislation within its strength and weaknesses will be explored below.

3.3.7 Legal Base of the Operating in the Arctic

The legislation of the environmental care varies from country to country. One of the global tasks of the Arctic development is the creation of a legislative base capable of protecting the environment. As it was mentioned earlier, some countries abandoned drilling in the Arctic due to the lack of scientific, technological and other resources to ensure the safety of the activities. Other countries are processing the Arctic exploration with various legal rules.

For example, Denmark made a strict policy about operating in the Arctic which made it difficult and unexpectedly expensive for oil companies to maintain their exploration activities. This led to the fact that some licenses off the west coast of Greenland were handed back by the end of 2014. For example, Norwegian Statoil returned three licenses saying: *"Our license commitments have been filled. Given the subsurface potential, the general cost picture and corporate priorities we have decided to exit the licenses."* (Offshore Energy Today, 2014).

In 2013 the new government in Greenland has slapped a moratorium on the granting of fresh offshore oil and gas drilling licenses in the country's arctic waters, saying it would be "reluctant" to hand out any new permits, while exploration under existing licenses could only be done under much heavier safety scrutiny (Macalister, 2013).

Experts note that the development of the Arctic shelf in Greenland will require huge investments, and it will not pay off at least in the next 10 years. For example, drilling a well requires the presence of an additional platform, which will be used in case of an accident (Chuprov, 2013).

Russia provides an "opposite" framework. The Russian government has been constantly blamed for a lack of legality basis and environment protection law. That makes Russian regions

financially attractive for the international oil companies due to lower expenses. Greenpeace Russian representative Vladimir Chuprov gives a comparable example: “One of the biggest oil companies, ExxonMobil, did not apply for a key competition in the industry - for the fate of the Greenland shelf area of 50 thousand square kilometers, which can hide up to 31 million barrels of oil equivalent. Exxon returned the two previously acquired land plots to the state since it considers the development of this area to be unpromising. At the same time, Exxon still calls the development of the Arctic in Russia, in partnership with the state corporation Rosneft, its priority. What is the principal difference of the shelf in Russia and Greenland? There are the same drifting ice, storms, and extreme working conditions. But in Greenland, drilling will cost significantly more because of the high and strict safety requirements. For example, drilling a well requires the presence of an additional platform, which will be used in the event of an accident. The next fact brightly speaks about the ecological standards in Russia: Exxon Mobil in partnership with ‘Rosneft’ has received a license for reconnaissance of resource sites in protected natural reserves”. (Chuprov, 2013).

In Norway, the responsibility for executing various roles within the petroleum policy is shared between the Ministry of Petroleum and Energy (MPE), which is responsible for resource management and the sector as a whole; Ministry of Finance, which is responsible for state revenues; Ministry of Environment, which is responsible for the external environment; Norwegian Petroleum Directorate (NPD), which is administratively subordinate to the MPE; Petroleum Safety Authority Norway (PSA), which has regulatory responsibility for safety, emergency preparedness and the working environment in petroleum activities.

The general legal basis for petroleum activities is contained in the Act of 29 November 1996 No.72 pertaining to petroleum activities (Petroleum Act), which provides the overall regulations and requirements for the award of licenses, the exploration phase, field development and infrastructure, joint activity and unitization of fields and discoveries within different licenses, decommissioning and cessation of petroleum activities (Svenson, Simonsen, & Lind, 2017). The Petroleum Act specifically regulates a licensee's liability for pollution damages, which is defined as damage or loss caused by pollution as a consequence of effluence or discharge of petroleum from a facility. Licensees are liable for pollution damage without regard to fault. (Leerberg, Vareberg, & Brøvig, 2016)

An Environmental Impact Assessment (EIAs) is required by law for the opening of new areas for petroleum activities. Before the opening of new areas for petroleum activities, the

authorities must evaluate the various interests involved in the relevant area, including assessing the impact of the petroleum activities on trade, industry and the environment; possible risks of pollution; any economic and social effects resulting from the petroleum activities (Svenson, Simonsen, & Lind, 2017).

Norway's expertise in energy production powers much of Europe; it can also power development in the Arctic. There have been oil and gas activities in the Norwegian Arctic for decades. Norway has chosen a gradual approach. Thanks to stringent requirements and strict regulation over the course of many years, the Norwegian oil and gas sector has one of the cleanest environmental footprints in the world. Greenhouse gas emissions from the Norwegian continental shelf are considerably lower than the international average for offshore production. At the same time, Norway managed to foster energy development without harming the interests of other crucial industries, such as fisheries (Brende, 2015).

The overview of legal aspects in different countries gives the conclusion that the policies and legal regulation vary from country to country. The most important goal of the global Arctic development is to create a unified system of high standards that will extend to all Arctic states to ensure the security of the development of the Arctic as one globally significant zone. It is obvious that the environmental issues are taken into account by governments, and most of the Arctic states are focused on the security of the Arctic development, which means that there is a governmental interest in arctic research and scientific projects designed to monitor the level of environmental safety, such as the ICE-POPE.

Conclusion

The PESTEL analysis of the macro-environment for the Arctic-focused project gives a conclusion that a product such as the ICE-POPE has a potential and a positive environment for its development. In general, countries understand the importance of sustainability in the Arctic development and are willing to strictly control international industry’s activities in the Arctic. At the same time, the Arctic development has high economic significance globally, and for local economies particularly. It means that the development of the Arctic is happening right now, and in the nearest future, its temperature will grow. Together with the growth of the activities in the Arctic, social awareness increases, and with the help of environmental organizations, society demands the highest responsibility of the governments and industrial companies. To show this responsibility, strong evidence of a sustainable approach is needed. For this purpose, the industrial companies and the Arctic states, who allow their activities, need

to use all available expertise and tools. It gives an assumption that in the nearest future the research and scientific projects, products and tools designed for arctic conditions will be in high demand. The ICE-POPE is one of these projects and has a high potential for development and further success in the market.

3.4 Market Segmentation

In the market overview and PESTEL analysis, the main groups of actors in the Arctic had been defined. The purpose of market segmentation is to define the main potential customers for the further development of the market strategy.

The overview of the political and legal aspects of the arctic activities showed that the international scientific-based operation standards and legal base which can apply to all Arctic states still needs to be developed, and deep scientific analysis and smart sustainable solutions are needed to build a unified global arctic strategy. That means that Arctic states and interstate organizations who are responsible for the Arctic development can be potential users of the scientific arctic-focused product, such as the ICE-POPE.

No less important, the non-governmental organizations who have politically independent and environment-focused strategies for the Arctic development, are also interested in the independent arctic expertise which makes them a potential user of the product.

The main player who is actually doing the activities in the Arctic and the main interest of all governmental and non-governmental policies is oil, gas and mining industry. This group is represented not just by corporations based in the Arctic states but also on an international scale. Any company can apply for a national license for Arctic exploration. Although some countries stopped giving licenses for operations in Arctic, these decisions are temporary and will be changed together with technical progress and the political situation in the nearest future. Meanwhile, Russia and Norway are still processing licenses. Russia does it through the state corporations such as Gazprom, Rosneft, Lukoil. Norway gives licenses directly. In 2016 Norway gave ten licenses to the companies below: Statoil (2), Det Norske & Russian Lukoil (1), Swedish Lundin (5), US groups Chevron and ConocoPhillips (1) and Britain’s Centrica (1). The map of zones for exploration is presented below:

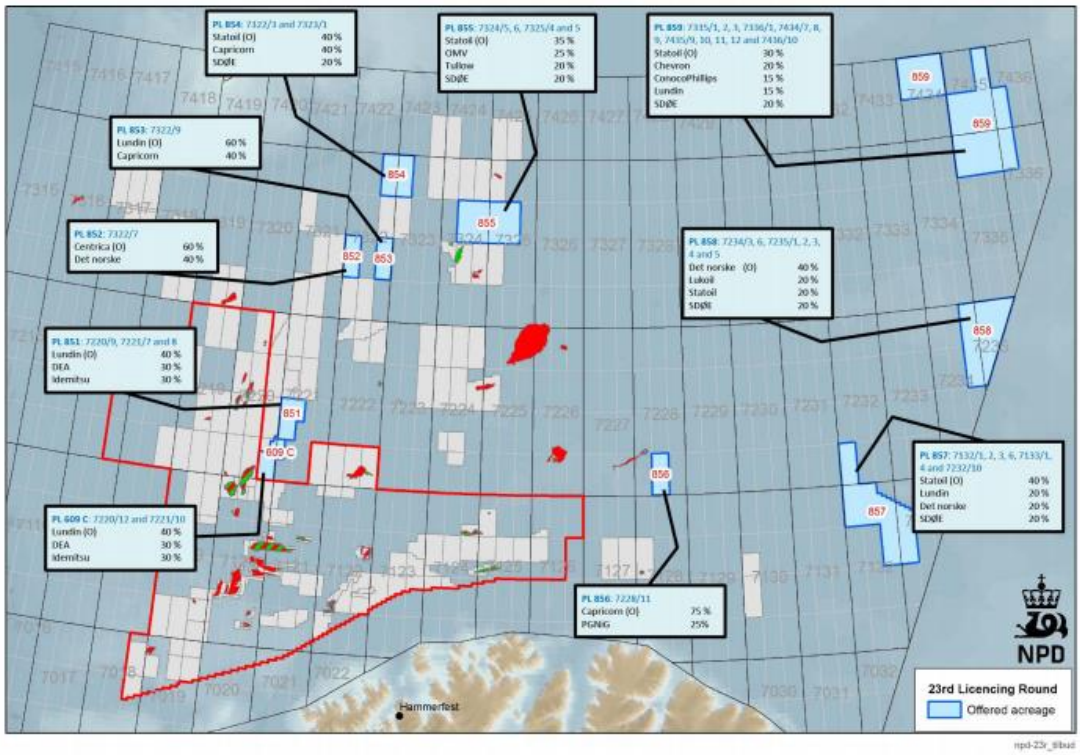


Figure 15: The map of Norwegian exploration zones 2017 (Norwegian Petroleum Directorate, 2017)

The biggest oil companies such as Exxon-Mobil, Shell, BP, etc. have significant share parts in Russian oil industry in collaboration with Russian companies Lukoil, Rosneft, and Gazprom. For example, the map below shows the agreement areas for exploration between the world biggest oil company Exxon Mobil and Russian oil giant Rosneft:

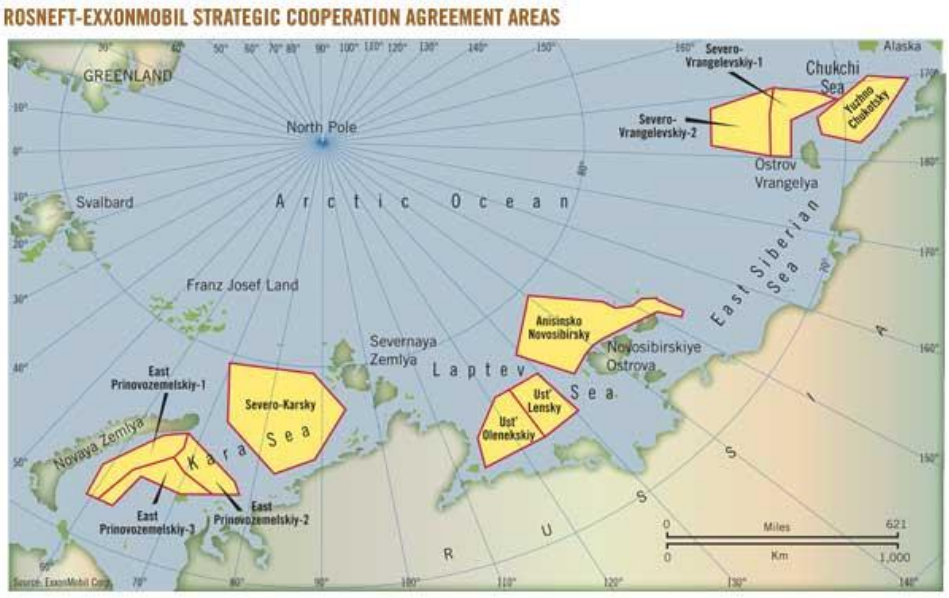


Figure 16: Rosneft & Exxon Mobil Strategic cooperation agreement areas (Greenpeace, 2014)

There are also still active licenses in Iceland – 60% CNOOC Iceland ehf., 15% Eykon Energy ehf., and 15% Petoro Iceland AS. Greenland has stopped giving licenses but there are still active long-term licenses held by Greenland national company NUNAOIL A/S in share with local companies and international corporations such as ConocoPhillips Global NVE, Shell, BP, Statoil etc.

The analysis of governmental policies and oil and gas companies' activities provides a clear vision that the Arctic exploration is in process, and will move further in the near future. The main groups of the stakeholders who have a need for arctic expertise are Arctic states and Interstates organizations, Non-governmental organizations and Oil industry. These three groups will be considered as potential customers for further market study. At the same time, the current situation according to national policies of the Arctic states gives a reason to focus on countries where the arctic activities are already happening, such as Norway and Russia. Since the ICE-POPE is a Norwegian research project (with international collaboration), the most reasonable option is to consider the Norwegian Market as the first potential market, where all three groups of potential users operate. The companies, who operate in the Norwegian market, are easier to reach since the ICE-POPE is a Norwegian project. That makes the companies, who currently have licenses for drilling in the Norwegian Arctic, the first potential users.

A short overview of these companies and their environmental policies is described below.

Det Norske Oljeselskap ASA is a part of Aker BP, which is a fully-fledged Exploration & Production company with exploration, development and production activities on the Norwegian Continental Shelf (NCS). Measured in production, Aker BP is one of the largest independent oil companies in Europe. Aker BP environmental policy underlines avoiding harm to the environment by contributing to the development of environmental studies and knowledge-based solutions, reducing the risk of any adverse effects on the environment as much as possible. The main aspects of their environmental policy are Biological diversity, Mapping of corals and sponges, Seabed mapping, Clean air and Clean water. (AkerBP, 2016)

Lundin Petroleum is an independent oil and gas exploration and production company with a principal focus on operations in Norway, with a portfolio of assets in Norway, Malaysia, France, the Netherlands, and Russia. Lundin Petroleum is committed to minimizing the impact of its activities on the surrounding natural environment, considering climate changes,

biodiversity conservation and oil spill preparedness as the main aspects of their Environmental Policy (Lundin Petroleum, 2017).

Chevron is one of the world's largest American energy corporation active in more than 180 countries. Chevron is engaged in every aspect of the oil, natural gas, and geothermal energy industries, including hydrocarbon exploration and production; refining, marketing, and transport; chemicals manufacturing and sales; and power generation. Chevron follows the following principles in their environmental policy: including the environment in decision making, reducing environmental footprint, operating responsibly, stewarding their sites. The environmental policy is focused on the following aspects: Accidental release prevention and response, Air emissions, Energy efficiency and greenhouse gas, Natural resources, Site residual impacts, Waste, Wastewater (Chevron, 2017).

Centrica PLC is a British company. Its principal activity is the supply of electricity and gas to businesses and consumers in the United Kingdom, the Republic of Ireland and North America. It is the largest supplier of gas to domestic customers in the UK. Centrica commits reducing energy's contribution to climate change while ensuring its wider environmental impact on water, waste, and biodiversity (Centrica, 2017).

All these companies have strong collaboration with Norwegian Statoil. Statoil ASA is the biggest Norwegian oil and gas company. It is fully integrated petroleum company with operations in 36 countries. The Government of Norway is the largest shareholder in Statoil with 67% of the shares, while the rest is public stock. The ownership interest is managed by the Norwegian Ministry of Petroleum and Energy. Statoil calls itself an industry leader in carbon efficiency. It promotes sustainability as a key point of company's development. The impact assessment process is an integral part of the overall risk management process in Statoil. Moreover, the company runs its own environmental projects and is involved in collaboration on environmental projects with other organizations (Statoil ASA, 2017).

The overview of the companies operating in Norway gives the conclusion that the easiest and the most promising customer to reach for the ICE-POPE will be Statoil ASA. It is the biggest Norwegian company with a government share. It represents country reputation and has strong sustainability principles that are realized in various projects. Moreover, Statoil collaborates with all other companies, who operate in Norway, having the power to influence their activities. All these factors make Statoil ASA the most attractive customer and the "low-hanging fruit" for the ICE-POPE. That can be considered as a start point for building the marketing strategy.

3.4. Competitor analysis

The ICE-POPE product is unique by its technology and the wideness of provided database. However, the market for similar services exists, and so do relevant competitors. It is essential to investigate the players in the market and understand them thoroughly. Entering the market without doing so not only results in high risk of failure but wasting invested resources.

Competitor analysis is made according to the broad-based managerial approach to competitor identification and competitor analysis (Bergen, Peteraf, 2002). This framework contains two stages. The first stage includes competitor identification, classifying candidate competitors on the basis of similarities in terms of their resource endowments and the market needs to be served. In the second stage, an evaluative approach is taken to answer the question of how well two firms serve the same need or how their capabilities compare. On the first stage the following competitors were identified (Table 4 in the next page):

	AOOS	Akvaplan-niva	NSIDC	ASL	DNV GL
Core business	A network of ocean observations, data, and information helping understanding Alaska's marine ecosystem.	Provide knowledge and advice on environment and aquaculture.	Provide scientific data for research focusing on snow and ice.	Provide solutions regarding oceanology, both products and consulting services.	A very wide range of products and services from maritime, energy, software, to business assurance.
Main value	Scientific research	Help to achieve high-quality production, sustainable operations, and long-term profitability (including the Arctic)	Scientific research	Innovative solutions for Offshore exploration and production (including the Arctic) + Equipment leasing.	Solutions to advance the safety and sustainability of business.
Line of products	Research projects, marine data in Alaska region.	Environmental assessments; Oil spill trajectory modeling and contingency planning; Operational decision support.	Research projects, scientific data focusing on snow and ice.	Consulting services including Flow Measurement, Numerical Modeling, Wave Measurement & Analysis, Sediment Transport and Ice Studies. Equipment leasing.	In a relevant field: Advisory; Inspection; Laboratories and test facilities; Marine services; Oil & Gas training; Verification and certification.
Technical values	Has a deep understanding and rich data in a specific area (Alaska). Has	Has studies and researchers working on exclusive projects in a	Has wide range data from glaciers, ice sheets, sea ice, snow, etc. High-	Various in-house technical equipment provided: ice-, acoustic-,	Strong fundamental in assets, people, and other resources due to company

	various tools to determine and analyze different types of map and data set.	range of marine, oil, arctic area, climate, ecosystem, etc.	experienced professionals and scientists collaboration.	and wave-related. Advisory service includes measurement, modeling, and data management.	size. Solid structure in specific section such as maritime. Contain numbers of certifications, publications, and research articles.
Technology used – ITP ITM AOFB	✗ ✓ ✗	| *Own technologies* |	✓ ✗ ✗	✓ ✗ ✗	| *Own technologies* |
Network and partners	• Alliance for Coastal Technologies (ACT) • Southeastern Universities Research Association (SURA) • Integrated Ocean Observing System IOOS	• Norwegian Institute of Water Research (NIVA) • The High North Research Centre for Climate and the Environment (FRAM) • ARCTOS International Research Network • Arctic Frontiers Conference Series • Other Cooperation with Russia	• NASA • The National Science Foundation (NSF) • The National Oceanic and Atmospheric Administration (NOAA) • Other federal agencies	• Maritime Way Scientific • Ocean Network Canada	(For maritime section) • German Maritime Arbitration • IMQ (Institut Maritime de Québec) • Newcastle University Marine International Singapore (NUIS) • Colombo International Nautical & Engineering College (CINEC)

Customers	Governmental organizations (for ex. The Arctic Council), local Alaska and Canadian organizations, research organizations.	Offshore petroleum industry (for ex. Statoil), shipping companies and public authorities, research organizations.	Scientists, researchers or organizations who look for specific scientific data regarding ice and snow.	Research organizations, oil and gas, mining industries, port and harbors.	Maritime, oil & gas and energy industries.

Technology features	AOOS	Akvaplan-niva	NSIDC	ASL	DNV GL
Real time data transfer	Low	Low	High	High	Medium
Ice Mass Balance	Medium	Low	High	High	Low
Temperature Sensor	Low	Medium	High	High	Medium
Salinity Measurements	Low	Low	Medium	Medium	Low
Light and Irradiance Sensors	Low	Low	High	High	Medium
Chlorophyll Sensors	Medium	Low	High	High	Low
Acoustic Zooplankton and Fish Profiler	Low	Low	Low	High	Low
Underwater Hyperspectral Imager	Low	Low	Low	Low	Low
Acoustic Doppler Current Profiler	N/A	N/A	N/A	N/A	N/A
Dissolved Oxygen Sensor	Low	Low	High	High	Low

Table 4: Comparative analysis of competitors

The table shows that various companies provide scientific database and analyses in the Arctic region. However, there are no companies who provide the same wide database and complex analyses of various environmental factors using technologies similar to the ICE-POPE. It gives a conclusion that there are no direct competitors who provide the exact same product to the same market. At the same time, the customer segment is similar for all companies. The closest competitor in these term is Akvaplan-niva, since it operates in the Norwegian market, and serves the commercial industry – oil and shipping companies, as well as public authorities. That gives a reason to explore this competitor more detailed in terms of relevance to the ICE-POPE.

The services provided by Akvaplan-niva are: Impact assessments; Pre-entry screenings; Vulnerability assessments; Accredited services; Environmental risk assessments; Oil spill trajectory modeling and contingency planning; Environmental screening analysis; Operational decision support. Although these services are not absolutely similar to the ICE-POPE, it is a quite wide specter of services and databases. Moreover, Statoil Company is one of the main clients of Akvaplan-niva. Since Statoil was identified as a potential first customer for the ICE-POPE, it is essential to find advantages that the ICE-POPE has in comparison to Akvaplan-niva. For this purpose, the SWOT analyses will be done further on.

However, Akvaplan-niva can be considered as not just the main competitor, but as a potential partner or customer. In this case, the company can become a link or mediator between the ICE-POPE and Statoil providing the ICE-POPE database as a part of its services. This scenario is less promising for the ICE-POPE company, as it carries more risks of technology diffusion and intermediary costs. It can be considered only in case if it is impossible to reach Statoil Company directly due to its strong relations with current providers or other reasons.

Another competitor with strong capacities is ASL Environmental Sciences. This company focuses more on flow and wave measurement; it also has a wide line of oceanographic equipment for leasing, including underwater vehicles and various measuring tools. Although the field of measurement is different from the ICE-POPE, this company has the same value – solutions for the activities in the Arctic, which makes it a strong competitor with the same customers. However, the example of ASL gives approval of the ICE-POPE market potential in the field of arctic solutions and innovative equipment.

The analyses of other competitors did not show direct threats. However, DNV GL is a large-scale organization with a high potential to be competing in the same market. With its

competency and assets, it could potentially invest in this field and develop its resources significantly to become a strong competitor in the future.

To conclude the competitors' analysis, the main findings are listed below:

1. There are several companies having different competencies and serving a different group of customers in the market. Their positions and strategies regarding how they operate and compete in the market we learned.
2. There is no direct competitor who provides the exact same product. However, relevant services exist in the same market. The closest competitor according to the market segment is Akvaplan-niva, who has Statoil Company as a long-term customer. It does not provide the same expertise, which makes the competition still possible for the ICE-POPE. Other companies do not have relevant products.

The competitors' analysis gives not only an overview of the market threats but also evidence of market demand for the services in the relevant field. For further study of the ICE-POPE potential in the market, a SWOT analysis will be applied.

3.5 SWOT Analyses

The analyses of the macro environment and competitors lead to the analyses of the internal factors that can influence the way of the ICE-POPE in the market. For this purpose, the strengths and weaknesses of the product must be explored together with its opportunities and threats. The SWOT analyses will be used for this purpose as the last step before the market strategy can be built.

The intention of SWOT, or strength, weakness, opportunity, and threat analysis, is to identify those internal strengths and external opportunities that an organization can leverage to accomplish its objectives, while also seeking to mitigate internal weaknesses and external threats (Lewis & Littler, 1997) The goal of the SWOT analyses based on its component is to evaluate product development by building on strengths, eliminating weaknesses, exploiting opportunities and mitigating the effect of threats. The table below shows the SWOT components of the ICE-POPE.

Strengths	Weaknesses
Technology: unique technology, set of equipment and methods. **Expertise:** unique arctic expertise made by the collaboration of the leading arctic universities (UiT, NTNU, UNIS) and research organizations. **Positive attributes of people*:*** expert knowledge, background, education, and network. **Relationships:** Support of Norwegian governmental organization, international collaboration with research organizations, strong network. **Location:** Local Norwegian project which helps to reach the users who operate on Norwegian territory	**High cost:** The very high cost of the equipment (approximately 5 000 000 NOK) which will require huge investment for the research aspects of the Arctic development by all stakeholders. **Construction time:** The construction and installation time is quite long, however, the same equipment can be used many times for different areas. **Readiness for wide production:** The project is still in the development stage, fast production of the equipment and employee hiring will be needed for market extension. **Arctic conditions:** Equipment can be destroyed by ice-crashes or polar bears.
Opportunities	Threats
Governmental support: The high chance to get governmental support that can make the environmental expertise obligatory for the industrial activities. **Be the first on the market:** The chance to become the first arctic expert on the market, reach the leading industrial companies to build long-term relationships.	**Lack of interest and governmental support:** The controlling organizations will not prove the ICE-POPE expertise as necessary, companies won't spend money for extra expertise. **Lack of experts:** The process of collecting and analyzing data needs time and particular expertise, which applies to a certain number of professional experts to run the business.

Table 5: SWOT analysis

In the Strength section, the following advantages have been identified. First of all, the technology of the ICE-POPE is its main strength and competitive advantage, as it was described in the Innovation study.

Not less important is the expertise of the project. The collaboration of the leading arctic universities (UiT, NTNU, UNIS) gives the ICE-POPE a reputation as a scientifically based expert. Support of international research organization (Scottish Association for Marine Science) strengthens the reputation.

The leaders of the project are well-known scientists with industrial experience and wide personal networks both in the research world and industry. Their expert knowledge, experience, and network are one of the internal strengths of the ICE-POPE.

Moreover, the ICE-POPE is a part of the ArcticABC project, which has financial support from the Research Council of Norway. Connection with governmental organization gives the ICE-POPE competitive advantage and potential for further development in the direction of governmental customers.

The fact that the ICE-POPE is a Norwegian project can be used as the country-of-origin effect (Elliot & Cameron, 1994), which is a psychological effect describing how consumers' attitudes, perceptions and purchasing decisions are influenced by a products' country of origin labeling. Norway is aiming to become an environmental leader (Ydersbond, 2014), and well-known for its environmental policies, activities and environmental expertise in general. That gives the ICE-POPE additional attractiveness for foreign companies, who claim to reach the Norwegian level of environmental care.

However, the ICE-POPE has relative weaknesses as well. The most obvious are the high cost of the equipment. The technology includes micro sensors and robotics equipment that has a high cost. For understanding the general principles of cost coverage in the oil industry, a Fugro company representative was interviewed. Fugro is a company who provide the people, equipment, expertise and technology that support the exploration, development, production and transportation of world's natural resources worldwide (Fugro, 2017). Practices of this company show that oil and gas companies order expertise from the very first stage, each order comes for very particular area. It means that the consulting company produces the entire necessary complex of work from scratch, including transportation of equipment and personnel to the research area (in the most of the cases it is an offshore area), installation, data collection, and analysis. The final product of such work is a report on the task (the cost of the report in Fugro Company can reach 20 000 euro). All costs for the work performed, which most often significantly exceed the cost of the report itself, are borne by the customer (can go up to 1 000 000 euro). Oil and gas companies usually cover the cost of equipment on a leasing basis, as well as the cost of transportation and offshore work in addition to the cost of the analysis and reports received. The example of ASL Company, mentioned in the competitor's analysis, proves this point as well. It allows assuming that the high cost of the equipment is not a critical factor for the industry, where any equipment has extremely high cost.

Another weak side is construction time and installation difficulties. As it was described in the Innovation study, an entire station is a complex of high-tech elements, each of which requires a certain production technique. Moreover, the establishment of the ICE-POPE Station on the ice or on an artificial ice platform cannot guarantee its safety due to harsh arctic conditions. However, any activity in the Arctic has its risks. There is a chance that the safety of the equipment can be strengthened with oil industry tools, which means that the problem can be solved. Moreover, there is no need to produce new equipment for each new operation. The same equipment can be used for different customers on a leasing basis, which will reduce costs as well. The main goal here is to have enough technological resources, including the equipment to cover demand. It leads to another weakness of readiness for wide production. The ICE-POPE project is still in the development stage. It is necessary to build the entire production and delivery chain at the moment market demand appears. However, it is a usual step of any industrial product development, and the main goal here is to build the infrastructure needed for the realization in time - before market extension starts.

Another SWOT part is analyzing of external factors such as opportunities and threats. The main opportunity of the ICE-POPE is to become the first provider of expertise in its field in the market. It will give a chance to reach the leading industrial companies and build long-term relationships that will ensure the ICE-POPE position. For this purpose, governmental support can also be considered as an opportunity. The most optimistic scenario takes a chance to get governmental support that can make the environmental expertise obligatory for the industrial activities.

Conversely, lack of government support can be a threat as well as the lack of companies' own initiative for environmental activities. Together these factors can cause a scenario where oil companies would not spend money for extra expertise for non-obligatory environmental activities. To avoid this threat, the market strategy will be built further.

The final treat that can appear is a lack of experts to cover market demand. The process of collecting and analyzing data needs time and particular expertise which applies to a certain number of professional experts to run the business. However, the network of the ICE-POPE project can be used for solving this problem.

The SWOT analysis gives a clear view of the ICE-POPE project from different perspectives. The findings of the analyses will be useful for building the market strategy, where strengths and opportunities can be used to increase the potential of the product, weaknesses can be solved and

threats avoided. The problems that can appear will also be covered by the planning tools in the business plan.

3.6 Market Strategy

The analysis of all groups of the arctic players and companies, who provide expertise in the relevant areas, allows schematizing the hierarchy of activity in the Arctic in the following way:

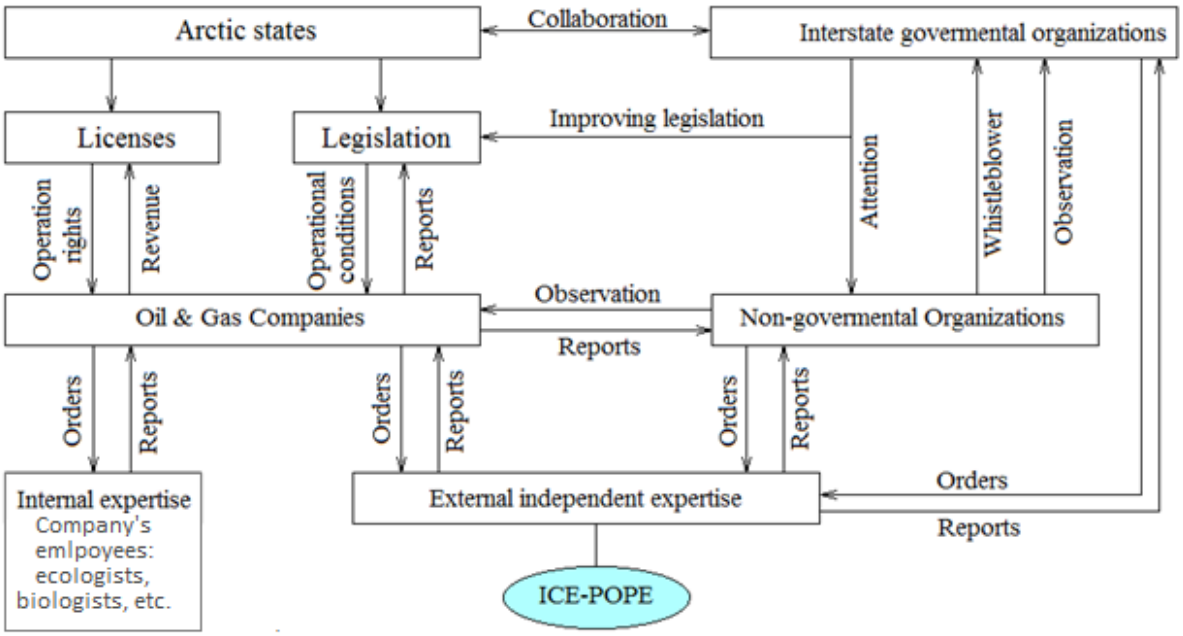


Figure 17: Hierarchy of the arctic activities (Author's scheme)

This hierarchy shows how all main actors collaborate with each other. Understanding industry's hierarchy and the ICE-POPE's potential place in it leads to the building the market strategy which will help to reach this place and successfully collaborate with other market players.

The overview of the market, its segmentation and PESTEL and SWOT analyses give an opportunity to see a whole market picture to build a market strategy.

3.6.1 Market Strategy – Crossing the Chasm

The analyses of the external and internal environment together with innovation study outcomes highlight a few features of the ICE-POPE such as:

a) The ICE-POPE is an innovative product, its technology is new for the market; a demand for the ICE-POPE must be created. In this case, the business will be built around the ICE-POPEs Station which will produce data for analyses, and a team of scientists who will analyze data to provide the final product – an environmental report.

b) The market for the ICE-POPE covers all actors of arctic activities, it requires a global approach on several levels simultaneously;
c) Thus, it seems reasonable to cover a few groups of the potential customers.

Based on these features, the Crossing the Chasm strategy seems to be the most applicable. It gives the framework for the market demand creation by inventing "the whole product" and reaching several market segments in the life cycle perspective.

Following this theory, "the whole product" concept for the ICE-POPE can be presented in the following way:

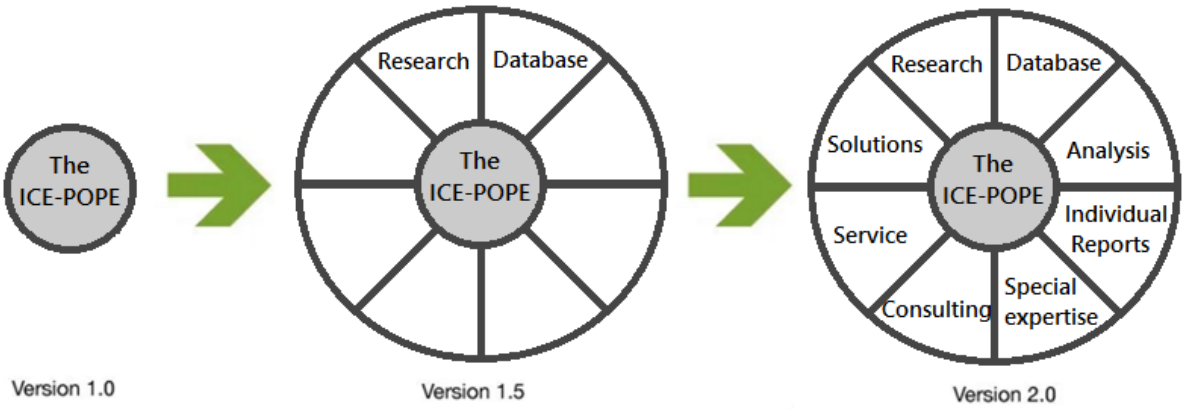


Figure 18: The ICE-POPE "The whole product" adopted by authors from (Moore, 1999)

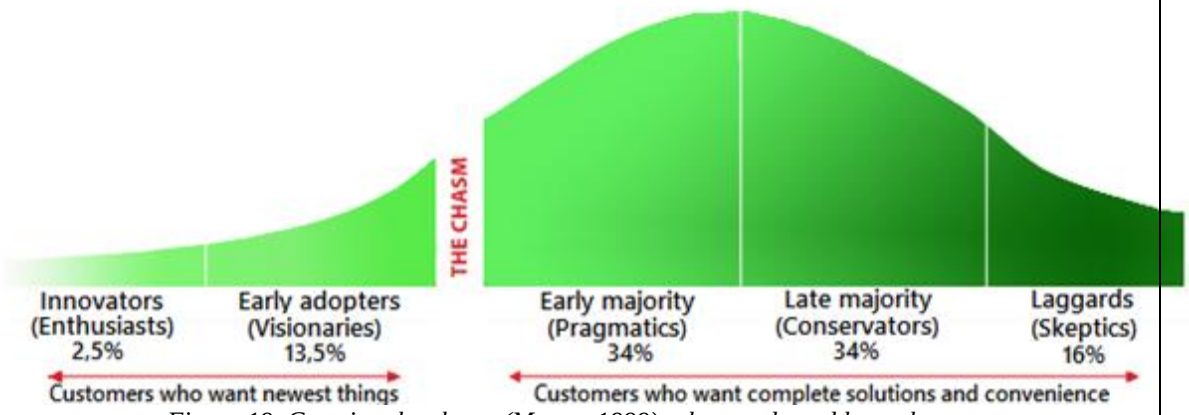
Here, the ICE-POPE is the original station which can be established on the arctic ice for measuring the environment under the ice. This technology presents a unique way for research and data collection in the challenging arctic conditions. Version 1.5 includes the database and research results that can be reached by the ICE-POPE. These results will be analyzed and presented by a team of scientists. Finally, version 2.0 presents the whole specter of services that ICE-POPE Company can provide, including the analysis of database and research, individual reports according to customers' needs, special expertise, consulting and services using the ICE-POPE equipment, and solutions that can be offered by the ICE-POPE experts.

Since the ICE-POPE is still unique in the market, the goal of the positioning will be to reach the status of unique arctic expert in its field and hold a significant market share until the technological progress brings new competitors, and then try to keep the position on the market as long as possible, updating technologies and products.

When the product is completed and fulfilled to "the whole product" it is time to define the distribution channels. According to Moore's framework, most distribution channels can be

divided into two categories: demand creators and demand fulfillers. The ICE-POPE is a new innovative technology that needs a demand to be created. At the same time, the potential market of the ICE-POPE already exists, and it can be characterized as relatively narrow, with established relationships and long-term players. Unless the product is well established in the market, it is necessary to have a direct sales force out in the market to explain the benefits of the product and need for it. When a product and its functioning are at its best, direct sales is the optimal channel for high tech. It is also the best channel for crossing the chasm. (Moore, 1999) Practically, it means that the ICE-POPE will need to be presented directly to each potential customer. However, in the market of such a global industry, cooperation with one of the major players in the market, where all actors carefully monitor each other's activities, gives instant growth of reputation and promotes the product in the market.

For the further development of the market strategy, the life cycle model of the ICE-POPE was designed:

Innovators (Enthusiasts)	Early adopters Visionaries	Early majority Pragmatics	Later majority Conservators	Laggards Skeptics
 *Figure 19. Crossing the chasm (Moore, 1999) scheme adopted by authors*				
× Scientists and bioengineers who need the newest technologies to perform their research activities	× Representatives of scientific professions who work for both for industry and research, and who will be the first person who analyzes information from the customer side	× Environmental-friendly proactive companies who run the environmental projects and research and "jump" into new opportunities × The companies who have environmental activities and are open to new possibilities and	× Companies, who are ready to pay for expertise, but require best practices, approvals of practical use etc. × Reputation-dependent companies who need to prove their	× The companies who proceed only for obligatory environmental activities × The companies who ignore environmental aspects of their activities × The local industries of the countries with

		interested in their image as competitive advantage × Governmental organizations who are responsible for environmental issues	sustainability for image × The highest level of the governmental organizations who need time to adopt innovations	low level of environmental protection

Table 6: Lifecycle perspective for the ICE-POPE (based on Moore, 1999)

Innovators and early adopters

According to this model, the first group is innovators or enthusiasts, who want the newest knowledge and technologies for their activities. For the ICE-POPE this group is researchers, scientists and bioengineers who created the ArcticABC project. Although they are creators, they also present a group of first users – scientists who will analyze data, both for research and industrial purposes. Early adopters appear on the development stage as well. For ICE-POPE it is a group of scientists, engineers, and researchers from different field and industries, who work on the ArcticABC project, test it in various ways and make their input into project development. It includes not just scientists who directly work with a project, but the ArcticABC network, which includes professionals who give their feedback and suggestions regarding further development. This is the current situation, although the first two groups are not customers who pay for service, they still have a significant role in the product development, and considered as enthusiasts and early adopters.

When development is done, the critical step is to move the product to the real market, offer it to the business, where customers will pay for it. This is crossing the chasm. The main goal of this stage is to reach the early majority.

Early majority

Environmental-friendly proactive industrial companies who run the environmental projects and research will represent the early majority. For instance, as was mentioned before, Statoil Company has a strong image of an environmental-care company in the oil industry; it runs its own environmental projects such as LoVe (Statoil/Havforskningsinstituttet, 2017). Moreover, the company represents the international image of Norway, which obligates it to keep a good reputation on the local and international level. Besides, the ICE-POPE is a Norwegian project. The combination of these factors makes Statoil company a “low-hanging fruit” for the ICE-POPE, which means that the Statoil might be the easiest first user to reach. As the first customer,

Statoil will be a tool for crossing the chasm from the research project to a business company, from a scientific project to the real market.

Another first customer can be an environmental company who constantly needs more tools to protect the environment and has an interest in all environmental aspects, explored by expert researchers. However, the environmental companies often pay a role of a "red flag" for the oil industry. It means that collaboration of the ICE-POPE with companies like Greenpeace can scare potential customers from the oil industry. It means that the environmental companies still can be in the first group of the customers, but collaboration with them will not be a flagman activity for the ICE-POPE growth. On this stage, the environmental companies can start involving the ICE-POPE in their research, but it will take time before they can operate this information for the environment protection goals. The main goal on this stage will be to reach the status of an independent expert, who provides expertise regardless the customers' goal – at the end of the day, the common goal of all potential users is to protect the environment. It means that image of the company should not be associated with conflicts between the oil industry and environmental companies. The ICE-POPE will play a role of a tool for resolving these conflicts.

However, if such significant market players as Statoil and Greenpeace are reached, it will be a powerful advantage for further growth.

After the very first customers, the early majority will grow with companies who have environmental activities and are open to new possibilities. The main interest for these companies will be a possibility to have a competitive advantage such as sustainability, which can positively influence their reputation.

Finally, at this stage, the governmental organizations who are responsible for environmental issues and activities in the Arctic can take some actions. However, the processes in governmental organizations always take a long time, which let assume that the real actions will happen just on the next stage. It would increase the chance to reach the late majority.

Late majority

The late majority is the customers, who need complete solutions, convenience, and in the ICE-POPE case, a strong reason to consider additional actions. This group is represented by the companies who are ready to pay for expertise but require the best practices, approvals of practical use etc. More possible customers for this stage are reputation-depended companies who need to prove their sustainability for a positive image. For example, the companies who

recently had events that negatively influenced their reputation caused social resonance and damaged the company image and client's loyalty.

At this stage, the highest level of the governmental organizations can be reached as well by industrial trends and attention of the environmental companies. Direct communications with such organizations are also possible in the earlier stages, but as it was mentioned before, the time factor will put this category of the customers in the fourth stage.

Skeptics

The last stage includes "laggards" or skeptics, who are barely interested in the market trends. It includes the companies who carry out only compulsory environmental protection activities, required by the law. These companies can be reached by the creation of a trend in the whole industry, social resonance caused by environmental companies or governmental obligations. Skeptics are also the companies who ignore environmental aspects of their activities, and entire local industries of the countries with a low level of environmental protection. As it was mentioned before, some oil companies such as Exxon Mobil or Shell have a high interest to operate in Russia, since the environmental law of this country does not require high expenses from the oil companies. This group of customers can be reached just with a long-term strategy, which will involve actions from the Interstate organizations, such as the Arctic Council, who can influence the local governments and make them change their environmental policies.

3.6.2 Bowling Alley & Tornado

The first suggested tool to cross the chasm is the "bowling alley". This concept pictures the market as bowling pins, where each pin is one segment of the market. Identifying the lead pin is critical to knocking down the others. The main goal of this strategy is to create a set of bowling pin target markets for the business. It can be the lead pin, two and more pins. The strategy allows taking this down to as many levels as needed. Then it is necessary to make sure that the transitional plans and content are in place to move from one target market to the next (Lieberman, 2012).

On this stage, few market segments can play a role of the lead pins. The possible options are drawn below:

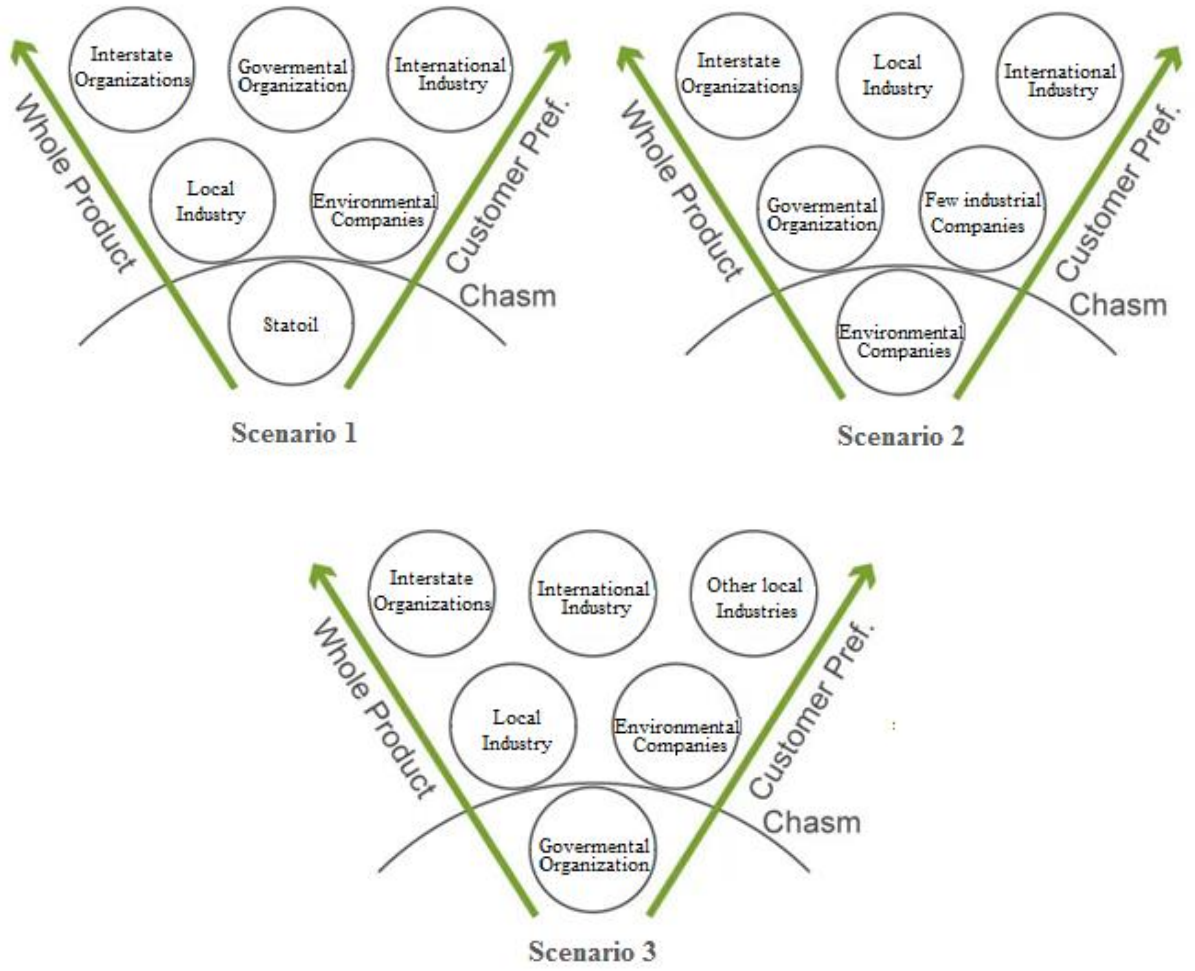


Figure 19: Scenarios of "Bowling Alley" (Moore, 1999) adopted by authors

The first scenario shows the most available way described above. Collaboration with a company like Statoil will knock down the local Norwegian industry. At the same time, the environmental organizations can start the actions. It can take the attention of governmental organizations, and their action will be seen by interstate organizations and international industry, which will cause a reaction as well.

The second scenario takes an environmental organization as the "lead pin". In this case, the action starts from the highlighted attention to the problem, which causes a social resonance and calls for action from the governmental organizations. At this stage, a few industrial companies can react positively as well. As a result, the local industry will have to respond, and it will take the attention of the interstate organizations and international industry.

The third scenario seems to be the most positive for the ICE-POPE, but the hardest to reach. The main pin, in this case, is a local governmental organization, which takes attention to the problem immediately, which causes the start of a change in regulations. It requires an immediate

reaction from the local industry, and environmental organizations increase their attention and social resonance on this stage. At the end, interstate organizations, international industry and the local industries of the other countries are called for action.

In all scenarios, the first "lead pin" causes "the tornado". This concept in the crossing the chasm strategy means the time when the building of the whole product is completed and the market demands the product. It's a time when a business needs to scale exponentially in order to keep up with demand. By the time when the "tornado" begins, the ICE-POPE must be completely established as a company with the necessary amount of resources to cover demand. It includes the necessary amount of equipment as well as expert professionals, who will provide the expertise demanded.

Coming out of the tornado to the main street is a period of relative calm for the business. The whole product has been built and proven in the market. The opportunities for growth are limited in scale but high in margin. This is when building an aftermarket program becomes the next big opportunity in the life cycle. The progress in technologies can extend the services provided by the ICE-POPE. The core to leverage a market position is long-term relationships with the customers fixed in the contracts. While the potential competitors are reaching the same level of expertise, the ICE-POPE having an advantage as a pioneer in the market, can move forward in the developing of new technologies and reach a new level of expertise to keep its position on the market.

3.7 Summary of Market Study

The ICE-POPE project is made to operate in the Arctic serving the environmental problem. The Arctic development is a global goal, which has a meaning for the entire world. The market overview showed that the main aspect of the Arctic development is an exploration of the Arctic as a global storage of natural resources. The PESTEL analyses gave the following groups of potential customers: Arctic states, interstate organizations, non-governmental organizations and oil and gas industry. The results of market segmentation showed that the most promising market for the ICE-POPE is Norway since it currently runs activities in the Arctic, it has strong environmental policies which make a positive environment for the ICE-POPE development, and the ICE-POPE is a Norwegian project. It also showed, that the most optimistic scenario starts from reaching the oil and gas industry, where Statoil ASA is a "low-hanging fruit" for the ICE-POPE. Nevertheless, the governmental organizations, environmental organizations, and

oil and gas industry had been considered as three main groups of potential customers for the ICE-POPE. The project can be involved in the activities of all of them.

For reaching these three segments of the market strategy had been built. The crossing the chasm strategy was taken as a basis, which gives the tools to operate in different market segments. The direct sales were chosen as the most suitable business model. The Statoil ASA was chosen as a "lead pin" for crossing the chasm using "the bowling alley" tool. Two other possible scenarios were also planned. The main goal of the strategy is to reach the early majority by crossing the chasm and move to the late majority. The strategy is consistent but not defined in specific terms. The development of the project and preparedness for the market still needs time. However, possible terms and details of project realization will be settled in the business plan.

4 Business Plan

4.1 Executive Summary

ArcticABC is a scientific research project run by researchers from UiT, NTNU, UNIS, and SAMS supported by Norwegian Research Council. The core of the project is the ICE-POPEs Station – unique measuring station with various sensors that provides a unique complex of environmental database collected under the arctic ice (Figure 20). The company will be called ICE-POPE as well.

ICE-POPE has identified three keys to its success. The first is the need to take attention to the environmental problems in the Arctic regarding human activities in the region. The second is to offer a complex solution of environmental care to those who operate in the Arctic. The third is to build long-term relationships on all levels of arctic activities – governmental, industrial, and environmental.

Figure 20: The ICE-POPE Station

ICE-POPE will be targeting governmental organizations, industrial companies (oil and gas), and environmental organizations. ICE-POPE will be an independent expert who provides data analysis and solutions to the costumers of all three groups giving them the possibility to make their activities in the arctic environmentally safe and sustainable. The first group is governmental organizations who have the power to control arctic activities by giving rights to operate in the Arctic and provide regulations for these activities. The governments of Arctic states and intergovernmental organizations have a global goal to make the Arctic development sustainable and budgets to involve scientific projects to serve this goal. The second group is environmental organizations (for example, Greenpeace) who observe the governmental and industrial activities in the Arctic and use social leverages and legal tools to prevent damage to the environment. These organizations have funding from individual donations and use their

budgets to point out threats and prevent dangerous activities. The third group is commercial corporations – oil and gas companies, who run activities in the Arctic for the purpose of extracting energy resources serving to the global energy demand. To operate in the Arctic, they have to meet several conditions, including environmental care aspects, provided by governments of the Arctic states. At the same time, they have to keep a social image for their customers showing their sustainable and environment-friendly strategies.

ICE-POPE Company is an arctic environmental consultancy that offers database analysis of various environmental indicators, including biological analyses, water indicators, current and ice movement analyses, etc. in the conditions of arctic climate including polar night. The database is presented in environmental reports including individual customer reports regarding particular arctic zones, analyses of the influence of human activities, consulting and solutions regarding operations in the Arctic.

ArcticABC project is led by Jørgen Berge, Professor of Arctic and Marine Biology Department at UiT, Geir Johnsen, Professor of biology at NTNU and UNIS who is a colleague of Berge and creator of a few key elements of the measuring station. The team is built from 38 researchers, scientists, and engineers from listed universities and partner organizations.

ArcticABC is currently in the development stage. It received 40,9 million NOK funding from Norwegian Research Council and has a 5-year term for development and testing. In 2020 the ICE-POPE Company will be launched for further commercial activities. By this time, the network of potential customers can be built for further long-term relationships.

4.1.1 Mission

ICE-POPE mission is to take a global attention to the environmental problems in the Arctic caused by human activities and provide innovative sustainable solutions for Arctic development. Through unique technologies, science-based expertise and professional networks, ICE-POPE will become a stable business serving the global Arctic development goals independently.

4.1.2 Keys to Success

ICE-POPE has identified several keys to success that will be instrumental in creating a sustainable business. If these keys are followed, the likelihood of success will significantly increase.

1. Taking attention of the involved parties to the environmental problems in the Arctic regarding human activities in the region.
2. Offering a complex, innovative and sustainable solution for environmental care to those who operate in the Arctic.
3. Building long-term relationships on all levels of arctic activities – governmental, industrial, and environmental.

4.1.3 Objectives

ICE-POPE has identified three objectives that it will pursue for the long-term success of the business:

- Science-based sustainable approaches to activities in the Arctic
- Become the leading arctic environmental expert within ten years
- Reach profitability within three years after finishing development
- Reach 30 customers in 5 years after a company launch (serving 85 ICE-POPEs Stations)

4.1.4 Key Points

- Ready for market in 2020
- Developed by leading scientist and researchers in the arctic field
- Serve the global environmental goal
- Get 40 million NOK funding from Norwegian Research Council
- First testing succeeds in January 2017

4.2 Business Idea and Business Model

4.2.1 Business Idea

Problem statement

The Arctic is a center of global attention due to its energy resources. The United States Geological Survey estimates that 22 percent of the world's oil and natural gas could be located in the Arctic. Oil and gas companies run activities of Arctic exploration, starting extraction in the coastal territories of the Arctic (Norwegian, Russian, Greenland and Alaska coasts). These activities influence the arctic environment. Besides the global climate changes and ice melting, the biological environment of the Arctic is also in danger. Changes in biological indicators of the environment can cause irreversible consequences for the Arctic region. That is why it is essential to observe and control the influence of the human activities in the Arctic.

The Arctic states governments, environmental organizations, and oil and gas industry have a common global goal to make the development of the Arctic safe and sustainable. For this

purpose, they need tools to control the environmental indicators, analyze environment condition, and build their activities' plan based on this analysis in a sustainable science-based way.

The Arctic development is a complex of events worldwide, that involves national budgets, various funds and corporation's budgets. Environmental programs are a necessary item of expenditure in these budgets.

Solution

ArcticABC is scientific research project made to explore the arctic environment. The core of the project is the ICE-POPEs Station – a unique measuring station which contains a complex of innovative sensors to collect data on environmental indicators in the Arctic. The station was built for arctic climate conditions, including rough weather, polar night etc. It can be established on the arctic ice, which is a unique technology, float around the Arctic together with ice movement. The data is collected by remote-controlled drones, which makes it easier and cheaper than existing methods of physical data extraction using ships and icebreakers.

The station gives a possibility to analyze various environmental indicators in its complex since all sensors measure different things and results can be connected. The unique set of sensors together with the general technology of data collection in the Arctic gives a full database that can show wide and deep information about the environment. Environmental analyses of this information provided by high qualified scientists will be used in an environmental report as the final product of ICE-POPE as a company. The report will help a company to control its activities' influence and build their development in a sustainable way.

The station can collect data in the particular location where it is established, but the analysis can connect data from the station locations on influence of the surroundings such as drilling stations or other objects nearby. A customer can order research from several stations in different locations.

4.2.2 Business Model

The model of ICE-POPE business will be based on pre-order of the environmental reports from various customers (Figure 21). When an order is received, the ICE-POPEs Station has to be established in the particular zone to analyze the environment according to customer needs. The place and period of analyses will be settled together with the customer. The place can be chosen according to activities planned – exploration, extraction, drilling. Data will be analyzed before,

during and after activities. The results will be presented in detailed reports, showing the environmental indicator changes, explaining its reasons and offering solutions for further activities. After the data collection is done, stations can be used in other locations.

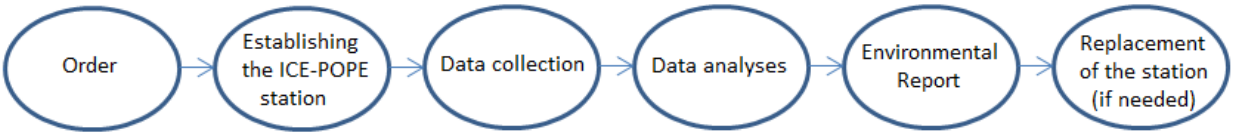


Figure 21: Business cycle

4.2.3 Profit Model

The profit model is based on three cost components: equipment, field work (equipment establishment and data collection) and the environmental report. The amounts that have been taken into account are:

Item	Price
The ICE-POPE Station	5 000 000 NOK
Establishment of the ICE-POPE Station	200 000 – 500 000 NOK

Table 7: Items' prices

The analyses of the industry showed that oil and gas companies who order any kind of reports from external consultancies pay the price of the report and cover costs of the field work and equipment used (on a leasing basis). The same model will be used for ICE-POPE.

The approximate cost of the ICE-POPEs Station is 5 million NOK. High costs need investment at the beginning, but it will be covered by the leasing fees. The station can be used many times in different locations which makes the station itself a subject of leasing. Field work, such as the establishing of the station, will be covered by the customer which means it is a price component but not a source of profit. The work of the company here is to deliver and establish the station at the chosen location. Then, data collection will be run by ICE-POPE specialists, and so will the data analyses. At the end, professional scientists will make a report which will be the final product that a customer will get (Figure 22).

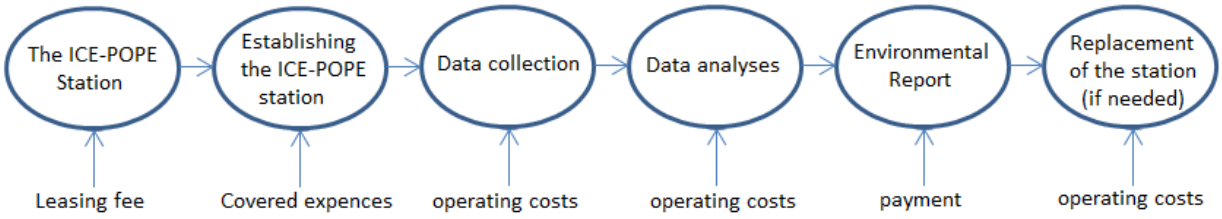


Figure 22: Business cycle sources

Thus, the profit will be built by two components: leasing fee and the price of the report, which combine consulting and leasing revenue models. Further financial aspects will be considered in the financial part.

4.2.4 Price Model

The price will be built in the following way:

Figure 23: Price model

This price is built in order to keep the cash flow constantly positive. According to the market research, this price is absolutely affordable for the oil and gas industry – their usual operations cost much more (1-week project costs can go up to 10 million NOK). However, environmental organizations do not have such high budgets. Even then, it is highly important for the company to have this segment of customers since these organizations work for a globally important goal which is closely connected with the company's mission. Moreover, environmental organizations can take a role of leverage to push government and oil and gas industry in the right direction, which can positively affect ICE-POPE Company growth. Taking these factors into account, ICE-POPE will provide services for environmental organizations for a lower price – 500 000 NOK. It seems acceptable for the company budget in long-term perspective, since environmental organizations are the smallest market segment which will be represented by no

more than 5 customers. Thus, for oil and gas industry and the Arctic states/governmental organizations, the company will charge 3 000 000 NOK per station per year, and for an environmental organization, the price will be 500 000 NOK per year.

4.3 Company Summary

The company is a Norway-based arctic environmental consultancy. It offers its independent expertise to governmental organizations, industrial companies (oil and gas), and environmental organizations who are in charge of arctic activities and looking for solutions to make the Arctic development safe and sustainable.

4.3.1 Start-up Summary

ICE-POPE will require the following steps in order to begin operations:

- Production arrangement for the ICE-POPE Stations. Stations will be built for pre-orders due the high costs
- Licensing arrangement with the owners of the project
- A team of managers who will build relationships with the customers and run the projects in future
- A team of scientists and engineers who will run the projects
- Powerful software developed specifically for the ICE-POPE for data storage and analysis
- A well-equipped working area for both teams, including powerful computers for data analyzing
- Rent arrangement for the sea transport to establish and remove the ICE-POPE Stations
- Accounting service as outsource

The approximate costs are presented below:

Item	Price
Production	Included in the cost of the station
Licensing agreement	10% of operating profit (before tax)
Management team	700 000 NOK per year per person
Scientist & Engineers team	850 000 NOK per year per person
Software	1 000 000 NOK
Working area	Equipment: 300 000 NOK
	Rent: 450 000 NOK per year
Sea transport rent	Included in establishing cost

Accounting outsourcing	300 000 NOK per year

Table 8: Start-up costs

4.3.2 Company Ownership & Intellectual Property

The ICE-POPEs technology is research driven by UiT, NTNU, UNIS and SAMS, UK. However, the final technology itself is owned by UiT, and any external commercial use of the technology would require licensing. To facilitate this licensing agreement, a DOFI (Disclosure of Invention) would be set up and a commercial license - owned by UiT and the inventor – would be granted to the external body to use the technology for business operations. Royalty payment will be counted as 10% from operating profit before taxes, which means the amount of revenue minus operating costs.

With regard to the business idea, the company would be owned by a third party, which can include researchers of the ICE-POPE projects.

4.3.3 Services

ICE-POPE offers complex environmental analyses and solutions related to the Arctic development and human activities in the Arctic. The main areas that ICE-POPE will enable are:

- **Biological Process Analyses:** The ICE-POPEs can be fitted with sensors to measure biological processes within the sea ice environment in order to see the effects of industrial activity on the ecosphere around that region. For example, the level of PAH (released through the process of oil drilling) on Arctic cod can be measured for further analyses by the team of experts.
- **Geochemical Process Analyses:** The ICE-POPEs can analyze geochemical processes underneath the arctic sea ice. This can enable the discovery of geological opportunities of the effect of certain processes and activities on the geology of the Arctic region
- **Industrial activity consultation:** The ICE-POPEs can enable the measurement and analyses of effects of industrial activity within the arctic on other processes and cycles occurring in that region. These processes on first glance might not seem related but upon further analyses by the team of experts, relationships might be found. For example, it might be possible to find out that industrial activity might be causing an increase in the number of copepods around the oil rigs due to the presence of light during business operations.

- **Environmental reporting:** The ICE-POPEs can enable the production of reports for relevant parties such as environmental organizations and other businesses with a stake in the Arctic regions. This might foster the taking and implementation of sustainable business decisions and ideas as well as provide an unbiased opinion on the state of the environment around these business operations.
- **Data provision:** the data gathered by the ICE-POPEs can be archived for retrieval at a later stage. This can provide access to data and knowledge about the arctic ecosystem which is severely understudied.
- **Technological Solutions and Services:** The ICE-POPEs may open up new areas for development of technological solutions within the sphere of arctic ice exploration. In addition to this, human expertise associated with the business idea will open up a wide range of research opportunities.

4.4 Market Summary

ICE-POPE has segmented the market into three distinct target market groups: oil and gas industry, the governments of Arctic states and intergovernmental organizations, and environmental organizations (for example, Greenpeace). The reason for choosing three segments is that all their activities are connected to each other, and at the end, they are supposed to have one common global goal of safety and sustainability, which ICE-POPE can serve to all three segments. ICE-POPE faces competition from companies, who provide different kinds of expertise in the Arctic and already have relationships with ICE-POPEs potential customers; however, there are no direct competitors who provide the same set of databases on the same high level of expertise. Besides the real need of the environment to be at the center of global attention, the general trend of environmental care makes takes social attention which makes it essentially both for governments and oil companies to keep their image as eco-friendly as possible, which can be achieved by running the environmental programs via ICE-POPE.

4.4.1 Market Segmentation

ICE-POPE has segmented its target market into three different customer groups, all attractive for different purposes.

Oil and gas industry

This customer group is made of oil and gas corporations, who run activities in the Arctic or are considering such possibilities in the nearest future. This is the biggest market and the main customer segment. The oil and gas industry is one of the basics of the world's economies, which

makes this group of customers the most attractive financially. The key points about this group of customers that makes ICE-POPE service valuable are:

- The oil and gas companies are obligated to meet particular environmental conditions to run their activities and provide reports about it. Some of these reports have to be done by external experts.
- The environmental image is highly important for the industry – harmful accidents or activities to cause global social resonance.
- Some oil and gas companies have its own value to operate in a sustainable way without obligations, and they run environmental projects by their own initiatives.
- The budgets of these companies are measured in millions, so as expenses. Each drilling station requires millions of investment already on preparation stage, for example, choosing a location for the station. According to Fugro company, the costs of such geotechnical project can easily go higher than 1 000 000 euro (10 000 000 NOK) which allows an assumption that the budgets for environmental projects can be significant as well.

Arctic states and intergovernmental organizations

The Arctic states segment is represented by 8 countries' governments and intergovernmental organizations, including the Arctic Council and others. Although it is not the biggest segment, it has a significant role in global Arctic development in general and industrial activities in the Arctic particularly. Involvement of this segment will have significant meaning for the industrial (oil and gas) segment as well. In the most optimistic scenario, governmental organizations can make the expertise which ICE-POPE provides obligatory to oil and gas industry. This group has a global goal to make the Arctic development sustainable, and budgets to involve scientific projects to serve this goal. Currently, the role of governmental institutes includes:

- Providing legal base for arctic activities
- Setting the scale of arctic activities
- Giving licenses for the activities to the industrial segment
- Controlling the activities and their influence
- Running environmental programs to make the Arctic development and arctic activities safe and sustainable

For the last purpose, the Arctic states and governmental organizations (such as the Arctic Council) need science-based projects and research to understand the full picture, make decisions and create their strategies and policies in a sustainable way. According to scientific

findings, states have the power to change operational conditions for industry and obligate some environmental conditions, such as ICE-POPE expertise.

Environmental organizations

International environmental organizations such as Greenpeace, WWF, Arctic Home and others, have a global goal to ensure the safe exploration and development of the Arctic region, protect the nature of the Arctic, and prevent damage to the global climate and environment. They coordinate sustainable development programs, disseminate information, encourage education and promote interest in Arctic-related issues. Being a constant observer of arctic activities, they see when a threat or real problem appears, and use various tools – from social resonance to court processes, to stop harmful activities. For this purpose, they hire various experts to have science-proven arguments for their activities. These companies can be not just a potential customer, but also a tool to empower attention to the problem, both social and governmental. Taking into account all three groups, the market can be presented in the following way:

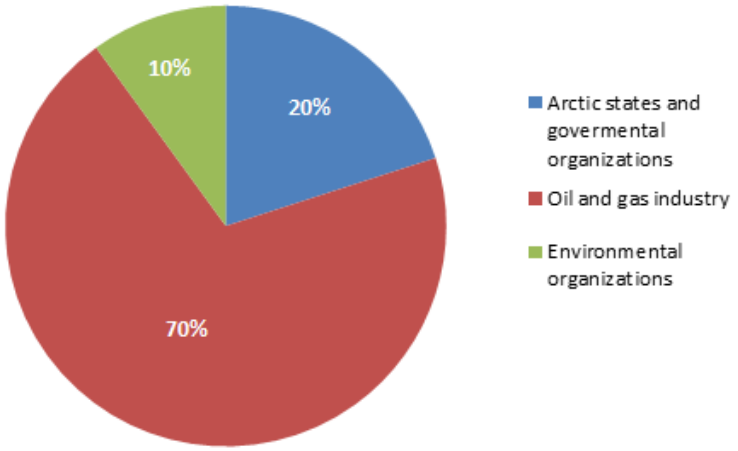


Figure 24: Market share between segments

4.4.2 Market Growth

Market growth will be run by increasing number of customers:

Customers	1st year	2nd year	3rd year	4th year	5th year	6-10th years
Oil industry	1	2	5	8	15	20
Environmental organization	1	1	2	4	4	5
Arctic states	0	1	1	2	4	5
Total	2	4	8	14	23	30

Table 9: Number of customers per year by segments

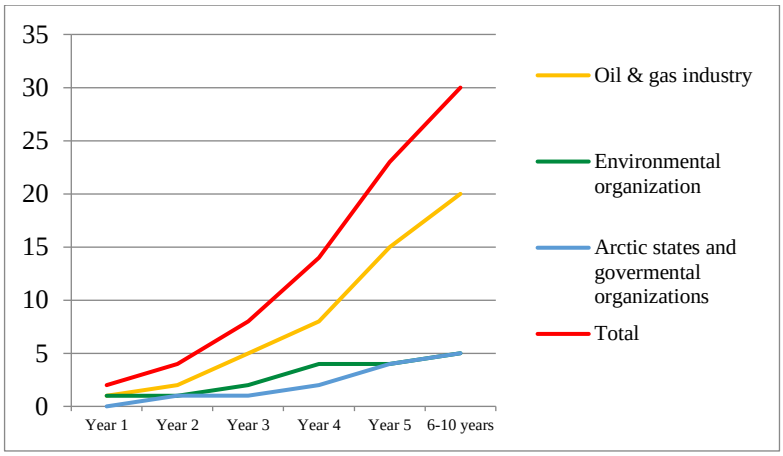


Figure 25: Number of customers per year by market segments

Although the market growth plan includes a quite small growth of the number of customers, the strategy is based on the point that customers, especially in oil and gas industry, will order more than one project (and station), which is presented below:

Customers	1st year	2nd year	3rd year	4th year	5th year	6-10th years
Oil industry	1	2	8	13	40	65
Environmental organization	1	1	2	4	4	5
Arctic states	0	1	3	5	10	15
Total	2	4	13	22	54	85

Table 10: Number of stations per year by market segments

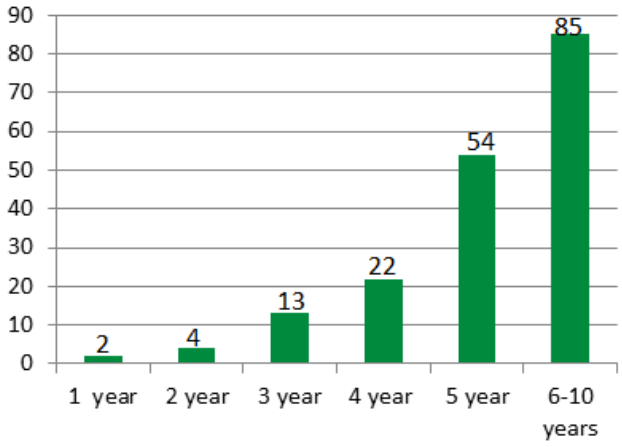


Figure 26: Number of stations per year

4.4.3 Competition

The competition in the field of arctic expertise exists, there are a few companies which provide various services regarding activities in the Arctic, serving mainly oil and gas industry. At the same time, there are several non-commercial research projects who work with a scientific purpose providing their findings to governmental organizations. The potential competitors and technologies used are listed below:

	AOOS	Akvaplan-niva	NSIDC	ASL	DNV GL
Core Business	A network of ocean observations, data, and information helping understanding Alaska's marine ecosystem.	Provide knowledge and advice on environment and aquaculture.	Provide scientific data for research focusing on snow and ice.	Provide solutions regarding oceanology, both products and consulting services.	A very wide range of products and services from maritime, energy, software, to business assurance.

Table 11: Competitor's technologies used compared

However, competitors' analysis showed that there is no direct competitor, who has similar technology to provide analysis the way ICE-POPE does. It is assumed that ICE-POPE has a potential to become the first arctic expert in the market, providing its unique technology and deep environmental analysis. The table below compares technologies based on ITO (ice-tethered observatory) used. Another table compares their technologies based on their features.

Technology features	Low → High
Real time data transfer	▲ ● ⬟ ■ ★
Ice Mass Balance	● ▲ ⬟ ■ ★
Temperature Sensor	▲ ● ⬟ ■ ★
Salinity Measurements	▲ ● ⬟ ■ ★
Light and Irradiance Sensors	▲ ● ⬟ ■ ★
Chlorophyll Sensors	● ▲ ⬟ ■ ★
Acoustic Zooplankton and Fish Profiler	▲ ● ⬟ ■ ★
Underwater Hyperspectral Imager	▲ ● ⬟ ■ ★
Acoustic Doppler Current Profiler	*N/A*
Dissolved Oxygen Sensor	▲ ● ★ ⬟ ■

▲ AOOS ● Akvaplan-niva ⬟ NSIDC ■ ASL ★ ICE-POPE

Table 12: Benefits comparison between ICE-POPE and competitors

To have a better picture, two main competitors are compared with ICE-POPE based on benefits regarding their products/services in the table below. Akvaplan-niva and ASL are selected due to their potential competitiveness and association with the market.

	Low → High
Technology uniqueness	
Scientific knowledge and expertise	
Range of services provided	
Market similarity	
Arctic data provided	
Other data provided –	
Biological	
Geochemical	
Environmental	
Technology solutions	

● Akvaplan-niva ■ ASL ★ ICE-POPE

Table 13: Benefits comparison between ICE-POPE and main competitors

The main challenge of the competition will be to reach customers who already have long-term relationships with companies-competitors. For instance, Statoil works with Akvaplan-niva, who provides wide expertise in various environmental aspects regarding industry. The main task of ICE-POPE will be to present new technology to companies like Statoil and make them consider new, or at least, second providers of environmental expertise. Another option is to turn competitors such as Akvaplan-niva into a partner who will connect ICE-POPE with Statoil. However, this is a less optimistic scenario due its intermediary costs.

4.5 Market Strategy

ICE-POPE market strategy recognizes and will leverage the fact that the industry is quite narrow (in terms of number of oil and gas companies) and customers are following each other's innovations regarding both competition and collaboration. ICE-POPE will try to reach “trend-makers” customers that can influence others. For instance, Statoil is a flagman on Norwegian market, and all other companies who operate in Norway look at Statoil. In the same way, Norway has a reputation in oil and gas strategies regarding national economy, and other countries and governmental organizations follow Norwegian examples while building their

strategies. That is why it is important to reach a company/organization with a good reputation and "trend-maker" status as the first customer.

ICE-POPE will rely on its innovative and unique technology as well as on expert knowledge to use this technology to give the customer the final product – the environmental report. At the same time, using unique technology such as the ICE-POPE Stations is also an advantage for the customers. The marketing strategy will highlight environmental attributes in order of safe and sustainable development of the Arctic region. The marketing campaign will recognize the existence of three distinct market segments. Lastly, the sales strategy will offer a complex environmental analysis using unique technologies and expertise, summarized in solutions of how the customers can make their activities environmental-friendly and sustainable by adopting ICE-POPE technology.

4.5.1 Marketing Budget

The main part of marketing budget will be used to visit potential customers in person. The market strategy will be also realized through the attending industrial events, such as conferences and exhibitions. Part of the budget will be used for this purpose. Attendance to social environmental events and social commercial regarding environment can also be considered as a part of the marketing budget.

4.6 Sales Strategy

The market of ICE-POPE is huge regarding financial aspects; however, the number of players (potential customers) in the market is limited, which makes the market quite narrow. Considering a limited number of oil & gas companies and governmental organizations, as well as specific of industry and costs of the ICE-POPEs Stations, the sales channel is only *direct sales*. Each customer needs special preparation to make an offer, and the approach to each customer has to be strictly individual. The ICE-POPE network, as well as a hired sale force, will be used to reach customers. The goal will be to leverage networks in establishing a market. However, it should not be a challenge, since all experts working on the ArcticABC project have their own experience in the industry and a strong network of connections in all market segments.

In conjunction with this, ICE-POPE will attend conferences and industrial exhibitions to increase exposure of ICE-POPE in the industry and increase networking opportunities.

4.7 Milestones

ICE-POPE is currently in the development stage. After receiving 40 000 000 NOK from the Norwegian Research Council, building and testing of equipment become possible, and so will further development with a strong team of experts.

The company will be able to start work when the development will be finished and the ICE-POPEs Station will be ready for industrial use. However, the launch of the ICE-POPE Company will be in the last year of development, to make a company ready for a "quick start". During this year relationships with customers in form of early agreements, negotiations and first contracts will start.

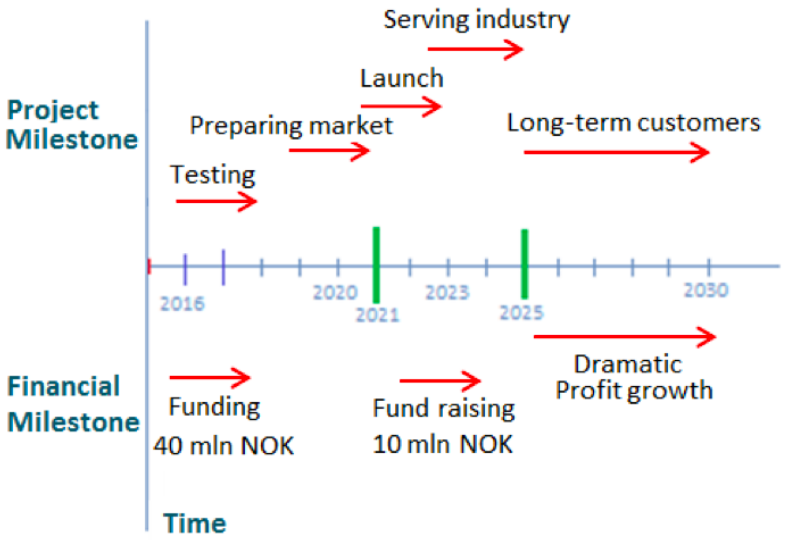


Figure 27: ICE-POPE milestones

During the first five years, the number of customers will grow which means that ICE-POPE will need to build more ICE-POPE Stations every year. The first three years after the launch the existing fund should cover these expenses. In the third year after launching the company, fund raising will be needed for the purpose of building the ICE-POPE Stations to serve more customers. Government funding, investment or bank loans can be a source. After the fifth year, the building of the stations will be stopped. ICE-POPE is assumed to work with 30 long-term customers, serving them with 85 ICE-POPEs Stations. Profit will start to grow dramatically.

4.8 Management Summary

The company will be led by a hired manager, who has a technical background and business development experience via industry. The second person will be responsible for ICE-POPEs

Station, data collection, and analysis, and will lead the team of scientists and engineers. The team can be built of the members of the ArcticABC project and its network. Ph.D. students, who are currently working on the ArcticABC project can be involved in the future as well.

4.8.1 Personnel Plan

For the first year of business, the organization will be quite lean, consisting of a Development Manager and Senior Bioengineer. The Development Manager will be responsible for most of the business-related issues, with the main goal to reach customers and build long-term relationships with them. The Senior Bioengineer will run the project of the customers, including all technical aspects and data analysis. ICE-POPE has forecasted that the number of employees will increase together with a number of the customers and projects (number of stations to analyze data from). In average, each employee from the scientists' team will run 4-5 projects a year. The management team will contain project managers, who will run relationships with the customers from the first sale, and after 5 years – an account manager will be involved instead of outsourcing accounting services.

	1st year	2nd year	3rd year	4th year	5th year	6-10th years
Managers	1	1	2	3	4	8
Scientist and engineers	1	2	3	5	9	15
Total	2	3	5	8	13	23

Table 14: Personnel Plan

An average salary of such specialists of both teams is 70 000 NOK per month (840 000 NOK a year). Salary plan is presented below. The increase in the salary is taken into consideration with regards to an increase in the number of projects. Thus, at the third year salary will increase to 75 000 NOK per month, for the sixth year to 80 000 NOK per month, and at the eighth year to 90 000 NOK per month assuming that employees will stay in the company during these years and increase the salary will be fair.

	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year	8th year	9th year	10th year
Salary payment per year (million NOK)	1,68	2,52	4,50	7,20	11,70	22,08	22,08	24,84	24,84	24,84

Table 15: Salary payment per year (million NOK)

4.9 Financial Summary

Regarding the fact, that production costs of one station are 5 million NOK, which is higher than a revenue from one project, it is impossible to build profit as long as the building of the stations costs more than revenue. That is why the ICE-POPE financial plan takes 10 years. After the 5th

year, the company will have enough stations to stop production and operate with existing assets (85 stations). Table 15 shows financial perspective for the first five years.

	2021		2022		2023		2024		2025	
	NOK	%	NOK	%	NOK	%	NOK	%	NOK	%
Revenue	3 500 000	100%	9 500 000	100%	34 000 000	100%	56 000 000	100%	152 000 000	100%
Stations production	5 000 000	143%	10 000 000	105%	45 000 000	132%	45 000 000	80%	140 000 000	92%
Operating expenses										
Salary	1 680 000	48%	2 520 000	27%	4 500 000	13%	7 200 000	13%	11 700 000	8%
Office rent	450 000	13%	450 000	5%	450 000	1%	450 000	1%	450 000	0%
Office equipment	300 000	9%	30 000	0%	60 000	0%	90 000	0%	150 000	0%
Marketing budget	50 000	1%	50 000	1%	100 000	0%	100 000	0%	100 000	0%
Accounting	300 000	9%	300 000	3%	300 000	1%	0	0%	0	0%
Loan payment	0	0%	0	0%	0	0%	500 000	1%	1 000 000	1%
Total expenses	7 780 000	222%	13 350 000	141%	50 410 000	148%	53 340 000	95%	153 400 000	101%
Earning before tax	-4 280 000	-122%	-3 850 000	-41%	-16 410 000	-48%	2 660 000	5%	-1 400 000	-1%
Royalty payment	0	0%	0	0%	0	0%	266 000	0%	0	0%
Income after royalty	-4 280 000	-122%	-3 850 000	-41%	-16 410 000	-48%	2 394 000	4%	-1 400 000	-1%
Tax	0	0%	0	0%	0	0%	957 600	2%	0	0%
Profit	-4 280 000	-122%	-3 850 000	-41%	-16 410 000	-48%	1 436 400	3%	-1 400 000	-1%

Table 16: Financial Plan 2021-2025

Profit appears already on the 4th year, but the5th year plan requires the building of 31 stations more, which breaks the profit again. However, on the 6th year when production is not needed, profit grows dramatically from 28,7 million in 2026 to 118,5 million in 2027 and stays stable at 117 million during the next years.

	2026		2027		2028		2029		2030	
	NOK	%	NOK	%	NOK	%	NOK	%	NOK	%
Revenue	242 500 000	100%	242 500 000	100%	242 500 000	100%	242 500 000	100%	242 500 000	100%
Stations production	155 000 000	64%	0	0%	0	0%	0	0%	0	0%
Operating expenses										
Salary	22 080 000	9%	22 080 000	9%	24 840 000	10%	24 840 000	10%	24 840 000	10%
Office rent	900 000	0%	900 000	0%	900 000	0%	900 000	0%	900 000	0%
Office equipment	300 000	0%	20 000	0%	20 000	0%	20 000	0%	20 000	0%
Marketing budget	50 000	0%	50 000	0%	50 000	0%	50 000	0%	50 000	0%
Accounting	0	0%	0	0%	0	0%	0	0%	0	0%
Loan payment	11 000 000	5%	0	0%	0	0%	0	0%	0	0%
Total expenses	189 330 000	78%	23 050 000	10%	25 810 000	11%	25 810 000	11%	25 810 000	11%
Earning before tax	53 170 000	22%	219 450 000	90%	216 690 000	89%	216 690 000	89%	216 690 000	89%
Royalty payment	5 317 000	2%	21 945 000	9%	21 669 000	9%	21 669 000	9%	21 669 000	9%
Income after royalty	47 853 000	20%	197 505 000	81%	195 021 000	80%	195 021 000	80%	195 021 000	80%
Tax	19 141 200	8%	79 002 000	33%	78 008 400	32%	78 008 400	32%	78 008 400	32%
Profit	28 711 800	12%	118 503 000	49%	117 012 600	48%	117 012 600	48%	117 012 600	48%

Table 17: Financial Plan 2026-2030

It is assumed that the leasing price using ten-year periods, and to have the first client by 2021, the time before that will be used for development and the company will generate no income.

The expected orders are to be 2 stations from customers from the oil industry and environmental organization for the first year. The company expects to have an order from Arctic states/governmental organizations in the second year. By year ten, it is anticipated to have 30 customers and 85 stations. The cost of establishing a station is set to be 500 000 NOK.

Costs of establishing the station vary from 200 000 to 500 000 NOK, depending on its location and other conditions. It is assumed that all stations have an average establishment cost of 350 000 NOK. This cost will be covered by clients as an extra cost to ICE-POPE's outsource sea transport providers, and as a result, this cost is not included in the budget. Moreover, for royalty payment, the company is to pay 10 percent of income before tax as licensing to the universities.

Figure 28: Projected profit

4.9.1 Expenses

Besides the station's production, the wage is the main expense for the business. A scientist with specific qualification will be hired and he/she will be working on analyzing data and generate reports for customers. Office rent and equipment will double from the sixth year since the company plans to have a bigger working space.

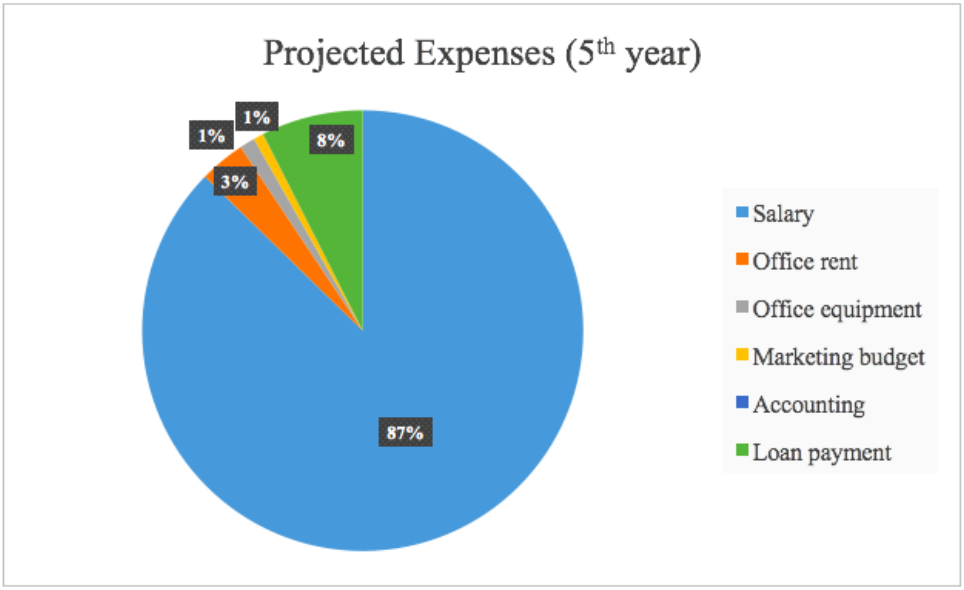


Figure 29: Projected expenses (5th year)

4.9.2 Assets and Liabilities

Initially, the company will have a capital of 40 000 000 NOK from Norwegian Research Council (NRC) which will be used for development and will be left 15 000 000 NOK as a starting capital. The company also plans to have a loan of 10 000 000 NOK on the third year for the purpose of production of the ICE-POPEs Stations to serve more customers.

4.9.3 Cash Flow

It is significant for a business to keep its cash flow positive, possibly not the first year but the first period of operating business. For the first year, it is mentioned that the company will have 15 000 000 NOK funding left from the capital. For the first five years, the amount of cash flow of the end of each year will be used as capital for further operations (shown as own capital in the table below.)

	2021	2022	2023	2024	2025
	NOK	NOK	NOK	NOK	NOK
Capital					
Funding (NFR)	15 000 000				
Loan			10 000 000		
Own capital		10 720 000	6 870 000	460 000	1 896 400
Total capital	15 000 000	10 720 000	16 870 000	460 000	1 896 400
Profit	-4 280 000	-3 850 000	-16 410 000	1 436 400	-1 400 000
Cash flow	10 720 000	6 870 000	460 000	1 896 400	496 400

	2026	2027	2028	2029	2030
	NOK	NOK	NOK	NOK	NOK
Capital					
Funding (NFR)					
Loan					
Own capital					
Total capital					
Profit	28 711 800	118 503 000	117 012 600	117 012 600	117 012 600
Cash flow	28 711 800	118 503 000	117 012 600	117 012 600	117 012 600

Table 18: Cash flow

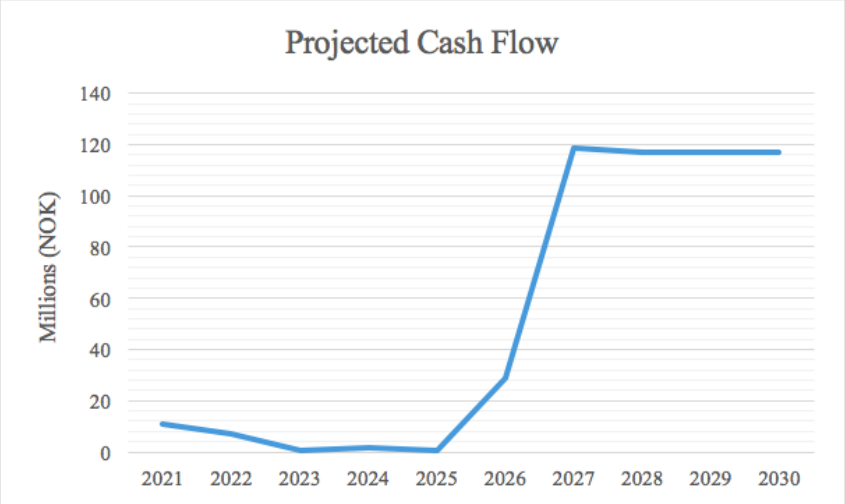


Figure 30: Projected cash flow

4.9.4 Offering

The company seeks for an investment of 10 000 000 NOK for the third year to assist its cash flow. The best option is to be supported by a government grant. If not, the company will have a loan from banks or investors, with an interest of 25%. The company will pay the loan back in year six, seven, and eight, by the amount of 500 000 NOK, 1 000 000 NOK, and 1 100 000 NOK, respectively. To conclude, the investors will profit from an investment by 125% within four years.

4.9.5 Exit Strategy

It is possible to exit during the year 7-10 since the company will be able to generate stable positive profit and cash flow and have to loan to pay back.

Acronyms List

4P	Marketing Mix 4P is a method for determining product strategy and product portfolio. It consists of four components: Product, Price, Place, Promotion.
7P	A marketing model comprising the original 4Ps plus Process, People and Physical evidence, as being more applicable to services marketing.
AHP	Analytic hierarchy process
AOFB	Arctic ocean flux buoy
AOOS	Alaska Ocean Observing System, Alaska, United States
ArcticABC	ArcticABC is a scientific research project run by researchers from UiT, NTNU, UNIS, and SAMS. The project belongs to the group of research organizations with originally scientific goal in biological and technological fields targeting the Arctic region which has financial support from the Research Council of Norway. The project is led by Jørgen Berge, Professor of Arctic and Marine Biology Department at UiT, Geir Johnsen, Professor of biology at NTNU and UNIS who is a colleague of Berge and creator of few key elements of the measuring station. The team is built from 38 researchers, scientists and engineers from listed universities and partner organizations.
AS	Aksjeselskap, the Norwegian term for a limited company
ASA	Allmennaksjeselskap, the Norwegian term for a public limited company
ASL	ASL Environmental Sciences, Canada
BCE	Master of Science in Business Creation and Entrepreneurship, University of Tromsø
CTD	Conductivity, temperature, and depth
DOFI	Disclosure of Invention
ICE-POPE	Ice-tethered platform cluster for optical, physical and ecological sensors
ICE-POPE Company	ICE-POPE Company is an arctic environmental consultancy that offers database analysis of various environmental indicators, including biological analyses, water indicators, current and ice movement analyses, etc. in the conditions of arctic climate including polar night.
ICE-POPEs Station	A unique measuring station with various sensors that provides unique complex of environmental database collected under the arctic ice.
ITM	Ice-tethered moorings
ITO	Ice tethered observatory

ITP	Ice-tethered profilers
LoVe	Lofoten-Vesterålen Ocean Observatory, a project resulted of a long-term joint work by Statoil ASA and Institute of Marine Research (IMR). LoVe is an initiative to further develop the knowledge base of the physical, chemical and biological environment as well as support the general monitoring of the key area.
NCS	Norwegian Continental Shelf
NSIDC	National Snow and Ice Data Center, Colorado, United States
NTNU	Norwegian University of Science and Technology, Norway
PAH	Polycyclic aromatic hydrocarbons
PESTEL	A PESTEL analysis is a framework or tool used by marketers to analyze and monitor the macro-environmental (external marketing environment) factors that have an impact on an organization. The result of which is used to identify threats and weaknesses which is used in a SWOT analysis.
SAMS	Scottish Association for Marine Science, United Kingdom
SIMBA	Sea ice mass balance buoy
SWOT	SWOT analysis is an acronym for strengths, weaknesses, opportunities, and threats and is a structured planning method that evaluates those four elements of an organization, project or business venture.
UiT	University of Tromsø, Norway
UNIS	The University Center in Svalbard, Norway
WWF	World Wide Fund for Nature, a non-governmental organization based in Switzerland

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