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Commercialization of Pinhole

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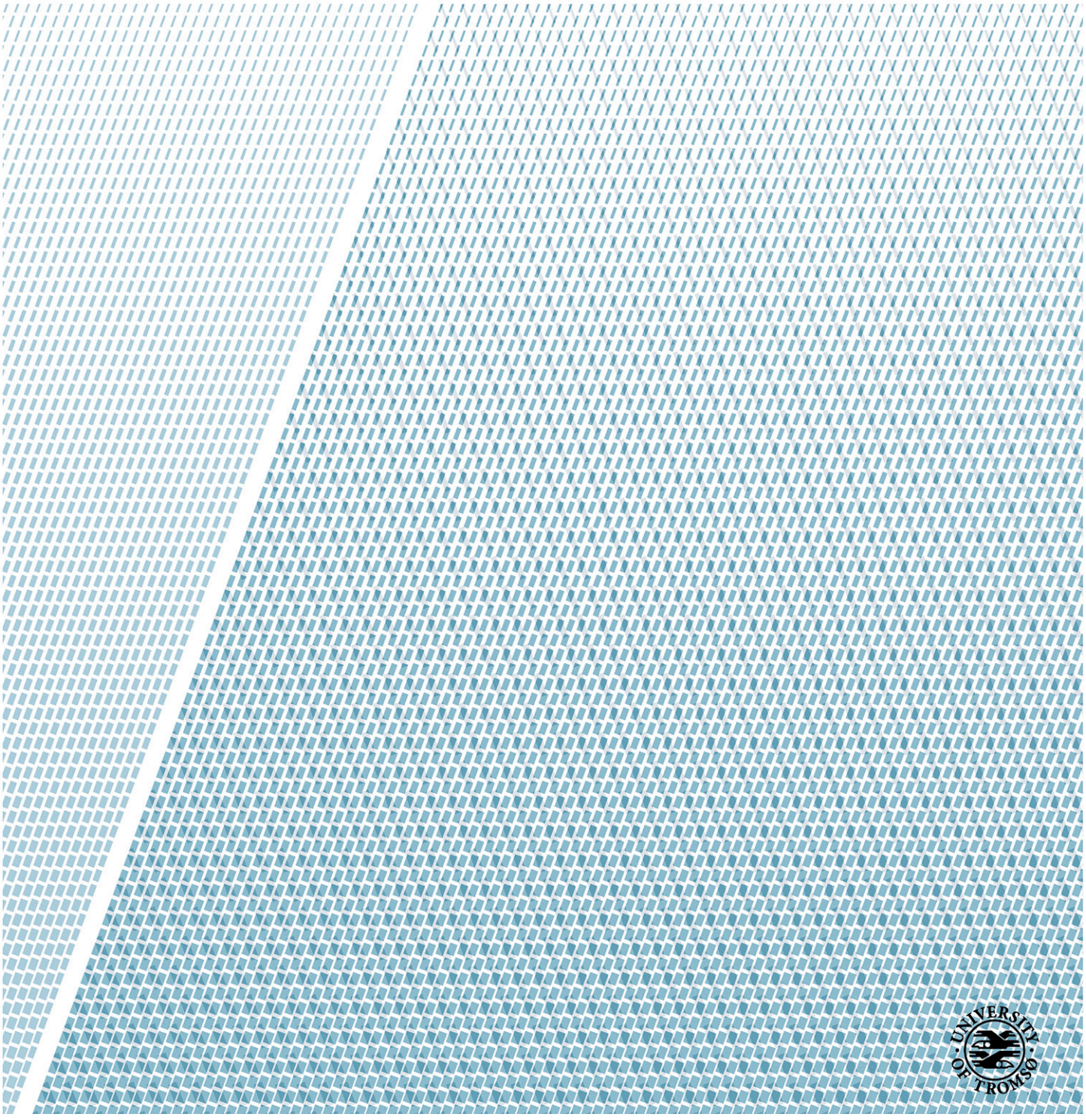

ABSTRACT

This thesis attempts to explore the market potential and commercialization process of Pinhole As. The objective of this research is to enlighten on: how the Pinhole innovation and technical factors will help the Pinhole to a successful and sustainable commercialization in the Norway Scandinavian and European market. To meet these objectives, the study relied upon the primary data, secondary data and interviews to identify and analyze the market opportunities in order to develop a market strategy for the Pinhole. The conceptual framework has been prepared on base of PESTAL analysis, SWOT analysis, industrial analysis, competitor analysis, market analysis and the growth potential in this sector.

Study finding indicate B2B marketing is more fruitful than B2C marketing for a start up like Pinhole. The fact finding suggests Pinhole to target the focus group to increase the market growth in Norway. The findings also suggest to target market segment like heart disease patients, professional athletes etc, as a market strategy to increase the sales within the Norway in the initial phase, Scandinavian in the second phase, Europe and all over the world in third phase.

Furthermore, the initial market entry strategy of Pinhole will bring positive vibes influencing the next initiative. This will help Pinhole to establish itself as a local brand in Norway to gain a goodwill and loyalty in local customers. Findings also suggest this market strategy as indirect mode will help Pinhole to have a decent market growth within Norway. This mode is also highly beneficial to handle the logistic and operation in the local region as well. However, there is hyper competition in medical multifunctional devices industries not only in Europe but also all around the world so; we can expect more start up industries in this sector in the coming further.

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ACRONYMS

AC: Alternate Current
CAGR: Compound Annual Growth Rate
CERG: Cardiac Exercise Research Group
CPA: Consumer Protection Act
CVD: Cardio Vascular Disease
DC: Direct Current
ECG: Electronic Cardio Gram
EKGs: Electrocardiograms
EPO: European Patent Office
ETPS: Economical Technical Political Social
EU: European Union
FTO: Freedom to Operate
FV: Future Value
GDP: Gross Development Product
IIS: Institutt for Ingeniorvitenskap og Sikkerhet
IKM: Institutt for klinisk Medsin
IP: Intellectual Property
IPO: Initial Public Offering
IPR: Intellectual Property Right
IR: Infra-Red
LEDs: Light emitting diodes
M&A: Merger & Acquisition
MFD: Multi-Functional Device
NACCHD: Norwegian Association for Children with Congenital Heart Disease
NCDR: Norwegian Cardiovascular Disease Registry
NOK: Norwegian Kroner
NSC: Norwegian Society of Cardiology
NTNU: Norwegian University of Science and Technology

PESTLE: Political Economical Social- Cultural Technological Legal & Environment

PPG: Photo Plethysmo Graphic

PV: Present Value

R&D: Research and Development

STEP: Strategic Trend Evaluation Process

SWOT: Strength Weakness Opportunities & Threads

UiT: The Arctic University of Norway

USPTO: United State of Patent and Trademark Office

VAT: Value Added Tax

WHO: World Health Organization

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1: INTRODUCTION

Today's era is filled with people having difficulties in their daily life due to dysfunction of human body parts. One of them is chronic heart disease which lead people to severe concussion such as unhealthy life, paralysis and even death. This thesis is based on the commercialization of medical device named Pinhole –an academic researcher from university of Tromso. The inventor of Pinhole is physic professor Torsten Aslaksen and owned by a team of three partners. In the team, Torsten is responsible for sensor development and hardware design. He has a broad experience in the development of diverse optical instruments and electromagnetic radiation. Vasyl Belyeyt is responsible for software development i.e., data collection, processing and analysing. He has more than 30 years long research experience in the field of ionospheric radio wave propagation and radars systems in different European universities. And the third partner is CEO Oleksandra Bieliei, She has graduated MSC entrepreneurship from University of Tromso and responsible for the administrative and business development. This idea is all about multi-functional heart monitoring device that enables convenient and comfortable continuous monitoring of the heart performance.

This chapter is a guideline for the readers and the purpose of this research is to attempt an answer for the question arises in the whole process. The answer is sought with the help of careful selection of an accurate theoretical concepts and the use of focused research methodology. This chapter gives a perception to developing market of technology based medical devices in the market in developing a society. Further, the chapter presents an overview of the frameworks for technical study, marketing study and business plan would be presented to help develop an understanding of the whole theme.

1.1: The importance of the topic

The topic of this thesis is how to commercialize a Biomedical engineering device. It combines design and problem solving skills of engineering with medical and biological science to advance health care treatment including diagnosis, monitoring and therapy. (2)

Commercialization strategy is one of the most crucial decisions a start-up makes in terms of its ability to profit from technologies developed within the university. According to the Heart organization(3) cardiovascular diseases are the disease related to heart and blood vessel disease. They are also called as heart disease. In other words, WHO defined, " these disease as a group of disorders of the heart and blood vessels and include: coronary heart disease- disease of blood vessels supplying the heart muscle, cerebrovascular disease- disease of blood vessels supplying the brain, peripheral arterial disease- disease of blood vessels supplying the arms and legs, rheumatic heart disease- damage to the heart muscle and heart valves from rheumatic fever, congenital heart disease- malformations of heart structure existing at birth, deep vein thrombosis and pulmonary embolism- blood clots in the leg veins, which can dislodge and move to heart and lungs". According to the WHO officials (4) an estimated 17.5 million people died from CVDs in 2012, representing 31% of all global deaths. An estimated 7.4 million were due to coronary heart disease and 6.7 million were due to stroke. The fact sheet also claim out of the 16 million deaths under the age of 70 due to non-communicable disease, 82% are in low and middle income countries and 37% are caused by CVDs. Hence, the number one cause for people death globally is Cardio vascular diseases and the number of people died globally is also gradually increasing every year than other cause.

This study is all about the adaptation of recent technology in an innovative way that improves our lives. There are many innovative multifunctional devices on research development, promising a bright future across the world to fight against the CVDs. Multi-functional device helps people to live healthier for longer life safely. In addition, it can benefit millions of patients to prevent from life threatening heart disease such as heart attract, stroke etc. and reduce the use of ineffective treatments and adverse reactions. It works more promptly and precisely to deal with the medical specific needs. Furthermore, several diagnostic test, surgical procedure, medication and effective treatment helps patient to deal with this disease. The study also further highlights economic benefit for the people to save money and time. This technology also has huge potential for growth and employment. According to the European competitiveness report 2013, depending on the medical device, growth potentials of 10 to 20% per year can be expected over the coming years. Recent advance in sensor technology and signal processing, those device are in high demand in the medical industries for health care. At present there is a considerably

and rapidly expanding market for health tracking device that is not giving much value to Norwegian companies. Statistical forecast indicates that the market value of the wearable device market will be double within next 3-4 year reaching up to $6 billion by 2016.(5)

Theoretically, university plays a vital role to create entrepreneurial networks by sharing different people concept and ideas, during the university activities. It not only facilitate the such networks for future research with broaden tacit knowledge but also help for commercialize opportunities linking with the different network outside the university.

Knowledge sharing, trust and further networking is very necessary for further business development during the commercialization process.

The specific role of university in networking activities, particularly the development of different type of networks, namely, social and business. (6)they further explain the role of university in facilitating such networks for future research should be limit up to tacit knowledge and trust building for successful networking. R&D networks is plentiful but network relationship in commercialization of innovations attract surprisingly little attention. The observation of the case studies on commercialization networks indicate that an innovating firm needs resources to engage in customer education, distribution, marketing communication, relationship mediation and credibility building when moving from R&D tasks to commercialization tasks. Hence to acquire these challenges, the firm needs to experience changes in network relation to increase their competence. "An innovating firm needs resources to engage in customer education, distribution, marketing communication, relationship mediation and credibility building when moving from R&D tasks to commercialization tasks". Hence to acquire these resources, an innovating firm need to quality network relations to increase their competencies in terms of accessing, managing and organizing relational resources. They should aware of other resource challenges such financing, human resources and operation activities.(7) The technology transfer office should be create to facilitate commercial knowledge from universities to practitioners(8)

1.2: Research Question

A Thesis research question (One or possibly two sentences) is the most important part of our thesis. It is a foundation upon which we write our report. We will create our research question and the whole reason, we are writing in our thesis to convince our reader. From the research and the market fact finding, Pinhole has a potential for successful commercialization. The market for multifunctional device is gradually growing every day. Research shows people are adopting new technology for their health care. Moreover, Pinhole product will be wearable to enable convenient and comfortable continuous monitoring of the heart performance of the subject of interest. Such a device will be able to assist people in monitoring and coordinating their lifestyle with respect to personal health condition, thus predicting and preventing possible health complications. Hence, it is very necessary to do further study to commercialize Pinhole successfully to tap the market potential and become a sustainable business.

The main research question of this thesis focuses on the successful commercialization of Pinhole and will be guided with sub research question related to technology and marketing. The main research question is *"What technical factors and market strategy will lead to a successful commercialization of the Pinhole?"*

- Technical Research Question: *Which technical factors will result in a successful commercialization of the Pinhole Innovation?*

In technical study, technology and functional potential will be evaluated by different dimension. What is technology function of Pinhole? What Pinhole's customer utilities are for prioritized use? What are societal utilities for prioritized use? And how can Pinhole make control on its innovative technology?

- Market Research Question: *How to identify and analyse the market opportunities in order to develop a market strategy for the Pinhole?*

In market study, Market potential and competitive analysis will be conducted. In addition, competitor analysis and SWOT analysis will do to tap the market status and the opportunities to form a suitable market strategy for Pinhole.

- Design Thinking: *How Design thinking process can be helpful for Pinhole?*

We will try to figure out how design thinking can be helpful for a new start-up like Pinhole for commercialization and standardization Process.

1.3: Methodology and Framework

1.3.1: Technical study frameworks

Innovation is a new idea, device or process. Innovation can be viewed as the application of better solutions that meets new requirement, in articulated needs, or existing market needs. (9) Hence, Novel device or new technology breakthrough in the market could have a great impact on the society. In this hyper competition today's market, innovation is must for any company to be successful. Without innovation, company can be out of date and cannot perceive the customer's need.

1.3.2: Innovation on pinhole product

There are many definitions of innovation and many ways of interpreting innovation types and process. Nieto and Mariano have explained the innovation process in a company as "a learning process through which a flow of new knowledge competences and capabilities are generated". (10)Hence, it is important that the flow of new information is continuous in nature, path dependent, irreversible and affected by uncertainty. Under Innovation we understand: Knowledge creation, research and development, technological development, learning, technological change and progress, technical change and progress, core competencies development, etc. Hence, Pinhole falls on product innovation category because it is a physical product, which is tangible and so called as health tracking medical device.

Knowing which type of innovation a particular idea relates to is very important as this may impact on different strategies of the company. We think that a lot of strategic decisions are linked to the fact of how the idea is perceived in innovation terms. Depending on the type of innovation, a new venture might utilize different commercialization approaches to fully embrace and manage. (11)

It is also very essential to learn which factors stand out in a breakthrough innovation.

Depending on the newness, innovation can be divided in to incremental (continuous) or breakthrough (discontinuous). (12) Where incremental innovation refers to minor change in technology, simple improvements, or line extensions that minimally improves the existing performance; breakthrough innovations relate to state-of-the-art technological advancement in a product category that significantly alters the consumption patterns of the market. (13)

Studies have also tried to further distinguish between the breakthrough innovations. The differentiation in these studies is based on innovation's implication on the technology and market. Thus they segregated these breakthrough innovations into "technology- based innovation" and "market-based innovation", where tech based innovations is more focused on adapting to new advanced technologies, and improved customer benefits related to the existing product in existing market. Market based innovations departs from serving the existing market and involves new and different technologies, as well as creating a set of fringe and usually new customer values for the Emerging markets. (12) Thus a tech based breakthrough innovation that fundamentally changes the technological trajectory and improves customer benefits are called "radical innovation".(12) An example of such innovation could be colour versus black and white television. On the other side, a market based breakthrough innovation that improves the performance through subsequent development to a level superior to the existing products and which eventually overtakes the existing product in the mainstream market is called disruptive innovation"(14)

We can also analyze the relation between market and innovation through a model.(15), in which they points out that in order for an innovation to achieve the status of being radical it needs to have certain degree of external newness, which essentially means that the idea not only has to be new to the company, but it also needs to be new to the market. In other cases where it is only new skills to the company or is only new to the market, the idea will contribute towards competence developing or market developing respectively. (15)

Another model that can assist a company to realize what type of innovation a project pertains to was presented by Christensen. (14) He mentions that every innovation falls somewhere on a 2x2 diagram, where the two axes are radical/incremental and disruptive/sustaining. Disruptive innovations pioneer new markets (usually growing on the edges of complacent incumbents); sustaining ones sell more into existing markets. Radical innovations are technically challenging; incremental ones are not.

As this disruptive innovation is described by Clayton Christensen as process in which a product or service starts from the bottom of market and targeting the initial goals before moving up to displace the already well established competitors.

1.3.3 Marketing Study Framework

Every entrepreneur has different ways of accomplish works but goal is the only factor that connects them. Successful business depends on effective strategic decisions, which are based on market information and market research is the best instrument that enables us to obtain all information and to reach our goal.

According to Philip Kotler, Marketing research is systematic problem analysis, model building and fact-finding for the purpose of improved decision-making and control in the marketing of goods and services.(16) Previously, it was aimed more at finding techniques to increase sales than to understand customers. Overtime, marketers increasingly recognized the importance of understanding buyers. Focus groups, questionnaires and surveys came into trend. Now days, it is believed that business get success through segmentation of the market and understanding buyers behavior. This market research carries out to identify the market potential of Pinhole As, which

help us to examine possible outcomes. The product developed by Pinhole is targeted to athletes and patients, they can use the device for their personnel use and also could take an approval from their doctors. So, we have focused on business to business (B2B) marketing.

Business-to-business marketing is where one business markets products or services to another business for use in that business or to sell on to other businesses for their own use.(17)

Commercialization is the process or cycle of introducing a new product or production method into the market. The key aspect of commercialization that Pinhole needs to address is;

i. Ideation stage - it is essential to look at many ideas to get one or two products or business that can be sustained long-term

ii. Business process stage - it is a stage-wise process and each stage has its own key goals and milestones.

iii. Engage stage - it is vital to involve key shareholders early , including customers.

Since, the Pinhole is looking for commercializing its product to the market. It should be aware that commercialization of a product will only take place, if the following questions can be answered:

1. When - when the company has to decide on the introducing timing

2. Where - where the company has to decide where to launch its products

3. Whom - to whom the primary target consumer group will have been identified earlier by research and test marketing (18)

A market analysis studies the magnetism and the vibrant of an unusual market within a unique and special industry. Market analysis is done under industry analysis and thus in turn of the global environmental analysis. In overall it analyzes the strengths; weaknesses, opportunities and threats (SWOT) of a company. Such SWOT analysis helps to identify and analyze business

strategies of an industry. It also recognized for the investigation made on a market that gives information on firm's planning, its activities and helps in making decisions, promoting activities and many more aspects of a industry. (19)

Pinhole requires strong market analysis since the market has changed rapidly and newer technological innovations are growing. Global challenges have suddenly risen and raised the standard. This framework provides overall information to understand how market analysis links to the Pinhole and what purpose the various market analysis tools serve. It largely depends on the context and objectives of each situation we encounter. We are trying to use flexible and adaptable approach where we can choose the most relevant analytical tool from market segmentation, PESTLE analysis and SWOT analysis for precise information.

The factors that might affect the market of our product could be internal and external environment. Internal environment to some extent can be prevented but the external factors are more beyond the reach of the company itself. To identify the environmental influence on Pinhole, we conducted the PESTLE (Political, Economical, Socio-Cultural, Technological, Legal and Environmental) analysis.(20)

The next tool used is customer segmentation which is one of the key elements of today's marketing. It is based on factors like; geographic, demographic and behavioral factors. By doing so the marketers will have a better understanding of their target audience and thereby make their marketing more effective. (21)This is due to the fact that by using the analytical process that puts customers first, the marketer will get more satisfied customers and thereby gain a great advantage over competitors.(22) Customer is the ultimate success factor of a company; customer satisfaction drives company to a newer height and allows 'moving power' to the company. We are in a customer centered economy where customer are regarded as core source and has an absolute power. Here, we have identified three groups: Group One – severe heart disease patients, Group Two - Athlete and Group Three - normal people. Based on this categorization, we think hospitals will be the appropriate place since, they hold overall information of such patients. We could get feedback regarding to our product and services. We would like to divide our market study into qualitative research and quantitative research for Pinhole. Qualitative

research in one hand undertakes through interviews, group meetings which serve as a primary information and on the other hand, Quantitative research will be undertake through questionnaire survey as a secondary source of information regarding the Pinhole product.

Another tool used will be SWOT analysis, as most researchers found it useful in a market study. SWOT analysis will help in making strategic planning for Pinhole. SWOT analysis is a method that summarizes all the internal and external factors of the sector's environment and analyze corresponding strengths, weaknesses, opportunities and threats. SWOT analysis provides information that can help in matching the sector's resources and capabilities to the competitive environment in which it operates.(23) Pinhole has its limited resources, SWOT analysis will help to make appropriate use and accurate match of its available resources. The main purpose of the SWOT analysis is to find the most favorable match of internal resources, capabilities and core competencies to develop competitive advantage and identify a position in the industry where the company can best defend it against competitive forces or influence them to its own favor. (24)

1.4 Limitations

This study deals with the sensor chip used in a wearable devices and software to read the algorithms produced by the chip. The technical information hold by the chip and the software is difficult to understand due to limited access on it. We tried to understand as much as possible with its limited access to us.

Another challenge is to get accurate and adequate information from the respondents. We had divided the respondents into two categories; doctor with their patients and professional athletes. We had conducted surveys in hospitals including cardiovascular surgeons and their patients. But, mostly we were disappointed due to their busy schedule and personal matters. On the other hand, Athletes are too busy to respond our queries. We had found very few respondents which leads to limited information. We tried to reach cardiovascular surgeons around the globe but mostly surveys were unanswered.

In addition, time is a biggest factor to get reliable data. 6 month of deadline to complete a thesis and to get a concrete answers is a biggest challenge for us. Only if we could have more time, we might be able to conduct more interviews which could lead us to a precise conclusion.

2: METHODOLOGY

2.1: Technical Description

2.1.1: Introduction to Wearable PhotoplethysmoGraphic (PPG) sensors

Most heart diseases are resulted due to the blood of a human body. Measuring blood pressure is difficult and the important cardiopulmonary parameter is blood pressure. Another important parameter is blood flow, which is related to blood pressure. It is possible to monitor the blood perfusion in large vessels using ultrasound devices, but it is not practical to use these routinely. Several devices for monitoring blood perfusion have been developed but it is difficult to find a practical device that can be use regularly.(25)

The perfusion of blood flow and blood pressure can be determined easily using a pulse rate monitor but it do not give any additional information regarding the heart condition. PPG sensors detect the blood volume changes in the microvascular bed of the tissue. The sensor system consists of a light source and a detector, with red and infrared (IR) light-emitting diodes (LEDs) commonly used as the light source. This sensor monitors the changes in the light intensity via reflection from or transmission through the tissue. The changes in light intensity are associated with small variations in blood perfusion of the tissue and provide information on the cardiovascular system, in particular, the pulse rate. Due to the simplicity of this device, wearable PPG pulse rate sensors have been developed. This review describes the basic principles of PPG, previous and current developments in wearable pulse rate monitors with a light source, and the elimination of motion artifacts.(25)

2.1.2: Principle of PPG sensors

Light travelling though biological tissue can be absorbed by different substances, including pigments in the skin, bone, and arterial and venous blood. Most changes in blood flow occur mainly in the arteries and arterioles (but not in the veins). For example, arteries contain more blood volume during the systolic phase of the cardiac cycle than during the diastolic phase. PPG sensors optically detect changes in the blood flow volume (i.e., changes in the detected light

intensity) in the micro vascular bed of tissue via reflection from or transmission through the tissue. A photoplethysmographic waveform, consisting of direct current (DC) and alternating current (AC) components. The DC component of the PPG waveform corresponds to the detected transmitted or reflected optical signal from the tissue, and depends on the structure of the tissue and the average blood volume of both arterial and venous blood. Note that the DC component changes slowly with respiration. The AC component shows changes in the blood volume that occurs between the systolic and diastolic phases of the cardiac cycle; the fundamental frequency of the AC component depends on the heart rate and is superimposed onto the DC component.(25)

2.1.3: Reflected and Transmitted Signals

The wearable PPG device shows reflectance and transmitted signals. In transmission mode, the light transmitted through the medium is detected by a PD opposite the LED source, while in reflectance mode, the PD detects light that is back-scattered or reflected from tissue, bone and/or blood vessels.

Transmission mode has limited measurement site however, it is capable of obtaining relatively good signal. So, to be effective it should be located on fingertip, earlobe where the light can be readily detected. Fingertip and earlobe sites have limited blood perfusion but yet they are the preferred monitoring positions. Reflectance mode eliminates the problems associated with sensor placement however it is affected by motion artifacts and pressure disturbances. There's a possibility that the measurement accuracy of physiological parameters may corrupt due to physical activity which leads to motion artifacts.(25)

2.2: Value Vision

Today the global health care system is undergoing the techno shift from youth to aged people, from developed to developing markets. Due to the flexibility and reliability makes the medical device more popular these days. The consumer patterns of health care and medical device in different countries are different and predictable. The developed markets have innovative; techno friendly, novel diagnostic devices whereas developing market are just established and growing. It

therefore has a potential in the developing markets and has a huge potential for the future growth.

2.3: Identifying and prioritizing situations of use

This analysis is about envisioning ways in which this idea could implement in the real world. That is based on the previous and future possibilities on health care and multi-functional medical devices industries are as follows:

2.4: Trends

The market forecast of the wearable device is 7.140 billion in 2015, 8.862 billion in 2016 and predicted to be 12.642 billion in 2018.(5) Various researches has been done on the trend of the wearable devices in which ABI research has mentioned that the medical wearable devices market will increase radically due to the latest and new techno trend. It will create number of opportunities and allows business to sustain in both long and short run. Hence, Pinhole's initial challenge will be to introduce its product and understand the product's sales potential and how the cardiovascular market might view a new alternative to existing option? So that Pinhole understand different market demands, competitive behavior analyze, trends and different market scenarios to develop an effective strategy in the market about the path forward.

2.5: Value adds

The medical device industry is very competitive, so the new comers should have to generate value by creating unique service that the customer wants. There is an opportunity but the new comers will not survive until and unless it is unique. Hence, Pinhole come with the value proposition, competitive price and convince. Value proposition by providing multifunctional device that will tract and monitor the heart disease by the simple wearable device. For the price, it will offer very competitive and meaningful price to attack mass market. Value for money by giving unique solutions to the customers what they need. In addition, for convenience, we will collaborate with the different medical companies such as biopharmaceutical, medical devices

distributor, hospital, and pharmacies outlets and provide to address their strategies and operational issues.

Our research shows that there is enough frustration among the customers about the reliability and the particular functions that customer wants. There is no magic formula to earn Goodwill in short period of time. Hence, Pinhole experts bring a forward thinking, collaborative style to build good reputation within the industries, prompt services and meaningful solution for the sustainable business that last.

2.6: Customer Utilities

According to Cardiac Exercise Research Group (CERG) at NTNU(26), over 30% of all Norwegians die from cardiovascular diseases (CVD). CVD represents the leading cause of death around the globe. Most likely everyone has a friend or family member or even suffering themselves from some form of heart related issue. Hence, this motivated us to come up with the best solution for the heart patients as a multifunctional heart tracking device.

From the customer point of view, It will be wearable (armband/watch/earring) to enable convenient and comfortable continuous monitoring of the heart performance of the subject of interest. Such device will be able to assist people in monitoring and coordinating their lifestyle with. So that the customer can use it as an option to track and monitor the heart performance during the daily activities such as work place, recreational and sports activities.

2.6.1: Cost Reduction

Electrocardiography (ECG or EKG) is the process of recording the electrical activity of the heart over a period of time using electrodes placed on a patient's body. These electrodes detect the tiny electrical changes on the skin that arise from the heart muscle depolarizing during each heartbeat.(27) . An ECG is a big machine with many loops stick on front part of the chest of the patients. According to the online medical distributor, a latest ECG machine can cost up to 3,895 USD(28) to purchase an entire machine which is not possible for a single patient.

Hence, Pinhole will be small in size, flexible in wearing and also it cost much less than a standard ECG machine. Pinhole products could be available in few hundred NOK. So, the customer could get the advantage of cost reduction.

2.6.2: Time saver

Generally, during the ECG testing, it takes a lot of time and different people are involving. Every single time the report is taken in certaintime frame and the heart activities are monitored by the doctors.

Hence, in case of Pinhole multi-functional device, it will be much faster, convenient. In most of the cases, customer themselves can track monitor and analyze their heart activities so that the customer will get an advantage of time saving.

2.7: Society Utilities

Each year cardiovascular disease (CVD) causes over 4 million deaths in Europe and over 1.9 million deaths in the European Union (EU). CVD cause 47% deaths in Europe and 40 % in the EU.(29) This clearly highlights that World Health Organization (WHO) and societal health institution has been spending a lot of resources for the heart disease across the world. As we all are the witness of heart disease has cause significant loss in our society.

2.8: Business Utilities

Based on the above facts and findings, we conclude that there is immense opportunity in multi-functional device. To tap the opportunity, Pinhole first task will be to organize a series of industrial conference, workshops to test the Prototype and implement the customer needs underlying assumptions about its product. During the Industrial workshops, Pinhole will explore the potential paths to market, licensing partners and contract deal.

For successful commercialization, Pinhole will analyze the competitive behavior, market demand and customer needs in multiple scenarios. There are already established companies in this market. Hence, Pinhole will offer innovation and design to value keeping the cost challenges and

technology structure in mind. So that it will be user friendly, cost benefit and very practical device.

2.9: Nest step of developing Pinhole

- In early stages of development hardware development, Software development is completed
- Chose right market
- Pre medical health market
- Child heart problems
- Prototype design
- First prototype by January
- Trials
- How to sell

3: MARKETING STUDY

3.1: PESTLE analysis

To make the marketing plan more effective and efficient we decided to employ PEST analysis. Both internal drivers and internal micro-environmental factors creates SWOT matrix. According to the Oxford University press PESTEL shapes the framework of macro-environmental factors such as political, economic/social and technological variables) used in the macro/ external environment scanning.(30) From our research, the earliest known reference referring to tools and techniques for 'Scanning the Business Environment' appears to be by Francis who discusses 'ETPS' – acronym for the four sectors of his taxonomy of the environment: Economic, Technical, Political, and Social. On the other hand, Arnold Brown for the Institute of Life Insurance (USA) reorganized it as 'STEP' (Strategic Trend Evaluation Process) as a way to organize the results of his environmental scanning. (31)

3.1.1: Political factors

Political issues are critical and relevant for any industry. It affects the profitability and efficiency of the company. And when Government is incompetent and helpless, it more complicated. Some of the factors under political are as follows:

3.1.1.1: political instability

Norway's political environment is among the most stable in the world. The fragmented party system has led to the formation of a large number of minority governments, fostering a culture where decisions are often taken on the basis of political consensus. After a period of minority government rule, the current Labor-led coalition holds a majority in parliament, which means that policy is largely subject to bargaining between the three governing parties, rather than in parliament. However, on longer-term issues, such as reforms to the public administration or of the pensions system, the government will seek broader majorities to avoid future policy reversals. Due to the stable political scenarios, business is well secure to operate and run in Norway.

3.1.1.2: influence of government policies that control the business

Operating risks in Norway are low, thanks to stable political and macroeconomic conditions. The governmental system is effective, providing high-quality services, and corruption is largely absent from political and business life. The economy is robust, sustained by strong domestic demand, high productivity levels and the booming offshore oil and gas sector. The international competitiveness of businesses operating in Norway could be undermined during 2008-09 by high wage growth. We also expect a modest appreciation of the kroner against both the euro and the dollar in 2008.(1)

3.1.1.3: Government directions regarding consumer protection

The Norwegian Ministry of Justice recently released a White Paper with proposed amendments to the Norwegian Consumer Purchase Act. Enacted in 2002, the Consumer Purchase Act establishes a relatively strong consumer protection scheme that *inter alia* includes mandatory regulation of several aspects of such purchases, e.g. delivery, defects, delay, sanctions and remedies.(32)

3.1.1.4: Overall government economic policy

Norway benefits from having an effective and accountable system of government. Legislation is prepared by an experienced civil service and often follows lengthy consultations with groups affected by any new laws. It must then pass through parliament's committee system, where the aim is usually to build a cross-party consensus, or at least a majority. Implementation of policy is carried out by a well-functioning decentralized governmental system. The local government reform proposals expected to be agreed in late 2007 are likely to alter the balance of power between central government, counties and local municipalities, with short-term risks for government effectiveness. One downside of Norway's governmental system is an occasionally excessive degree of bureaucracy. The relative absence of corruption in public life is expected to persist. Cronyism has been associated with past Labor governments, but the risk of this significantly affecting private/public decision making is low.

3.1.2: Economic Factor

It plays a major role that affects the wearable medical devices such as Pinhole and many others from other industries.

3.1.2.1: Average salaries and wages

The graph below shows that an average monthly income of a full time employee in Norway. the average monthly wage for all salaried employees was Nok 36,700 in 2010. The highest and lowest paid average monthly wage was Nok 71400 and Nok 20,600 respectively. Directors and chief executives had an average monthly wage of Nok 68,400 in 2010. (33) This gives a clear idea that the Norwegian market can afford the multi-functional devices .

3.1.2.2: Average spending on health care devices

Norway's medical device market is mature and highly advanced. In 2008, the market is valued at $1 156 million and expected to grow by 7.4 % per annum. In 2006, Norway imported medical devices for $849.7 million (11 % growth to the previous year) and exported $330.9 million worth medical devices. Local production is in small scale and thus it is expected that the increasing market demand would be met by imports. (34)

3.1.3: Socio-cultural factor

3.1.3.1: Demographic of the population

The Norwegian population will continue to grow throughout the century, according to the medium alternative in the population projections. The growth will be particularly high in and around the larger cities. The aging of the population will continue, and every fifth resident in Norway will be at least 70 years of age in 2060.(35)

Year (Projections)	2013	2020	2040	2060
Nominal numbers	5,109,056	5,450,106	6,323,563	6,868,230
Deaths	41,282	42,463	56,443	65,674

Table 1: Registered and projected number of population and deaths

3.1.3.2: Deaths due to cardiovascular disease

In 2012, statistics from the Norwegian Cardiovascular Disease Registry show that 10,500 people had an acute myocardial infarction and 9,000 had a stroke as the main diagnosis. This indicates the following annual statistics for heart attacks and strokes:

- **Heart disease:** Approximately 15,000 people have an acute myocardial infarction each year. Half of these are under 74 years-old. In addition, there is an unknown number who have angina pectoris, heart failure or other forms of heart disease.
- **Stroke:** Approximately 13,000 have a stroke every year. Half of these are under 76 years-old. A study from Nord-Trøndelag suggests that one in four strokes occurs in patients who have previously had a stroke. (36)

3.1.4: Technological factors

3.1.4.1: Science and Technology

A highly advanced industrialized nation, Norway invested $2,625.414 million or 1.6% of its GDP into research and development (R&D) in 2001. Of that amount, 51.7% came from the business sector, followed by government sources at 39.8%. Foreign sources accounted for 7.1% and higher education at 1.4%. In 2002, high-tech exports were valued at $2.863 billion and accounted for 22% of manufactured exports. Public funds come either as direct grants from the central government or as proceeds from the State Football Pool, whose net receipts are divided between research and sports. In 2001 (the latest year for which data was available), there were 1,524 technicians and 4,442 scientists and engineers engaged in R&D per million people.(37)

3.1.4.2: Wearable technology market

It is a niche market with current domination of a few players. As the technology is new and there are few players, the prices of the products are high. However, the applications of wearable devices are currently spanning across sectors such as fitness and wellness, infotainment, healthcare and medical and industrial and military. Additionally, the applications of these new technology products are expected to increase with further development in the devices, over the forecast period. The wearable technology market is segmented by application into fitness and wellness, infotainment, healthcare and medical, and industrial and military. Various products such as smart clothing and smart sports glasses, activity monitors, sleep sensors, smart watches, augmented reality headsets, and monitors in the wearable technology market are further included under these applications. These are further segmented into products with several features. For example, outdoor activity watches have been segmented into watches with altimeter, barometer and compass. Similarly, running watches have been segmented into watches with heart rate monitors and without heart rate monitors. Other products have been further segmented and covered in the report. Among these, the fitness and wellness segment accounted for the highest market share in 2012 and is expected to maintain its position throughout the forecast period due to rising adoption of wearable technology products.(38)

3.1.5: Environmental factors

It is considered as an external aspect which cannot be ignored by the industries and companies. General awareness among the customers, consumers regarding the environmental hazards, global warming had forced companies to make adjustments on their way of doing business and business policies. Living in Norway means enjoying a comfortable city life as well as living in an ecosystem-centered value system. Norway not only recognize the risks of climate change, but also tries to limit it. Through ecology, Norwegian society expresses its deeply egalitarian and humanitarian ideas. (39) Consumers are demanding high quality product in affordable price but also environmental friendly production. It is an obligation for companies to follow environmental friendly production in order to maintain their good corporate image in the society and goodwill of the company. As a result, Pinhole will involve in conservation of energy and use

clean energy for the production of its product. The technology and other resources will be used in optimum level to minimize waste. The situation about environmental issues is more or less the same in all Scandinavian countries and Europe.

3.1.6: Legal Factors

It is considered as one of the important factors since; the whole operation of a company's business depends upon the rules, regulations and laws enacted by the government for well being of all stakeholders. For the purpose of this thesis, we found a law which is significant to Pinhole product.

Medical devices are defined in the Act of 12 January 1995 No.. 6 Medical Device § 3 and Regulation of 15 December 2005 no. 1690 concerning medical devices § 1-5. Medical equipment must meet the basic requirements in regulations and directives before the device can be CE marked indicating that regulatory requirements are met. (40)

3.2: Industry Analysis

To understand the competitive situation of the industry we implement the Five Forces Model.(41) The framework works as an efficient tool to establish the charm and magnetism of an industry, further this analysis intend to provide a brief understanding of the industry and helps untie the opportunities and threats associated with multifunctional wearable devices. Industry structure drives competition and profitability, not whether an industry is emerging or mature, high tech or low tech, regulated or unregulated.

3.2.1: Rivalry among competitors

Wearable medical devices have been grown in the past few decades. Numerous companies has introduce various devices identify and monitor the heart rate. These devices are in different size, design etc. The closest competitors are 'My Basic and Prediktor' which has almost the same functions and technicalities that the Pinhole device has. The difference that makes our product superior is the algorithm that pinpoints the heart related issues in human body. These products are competing each other to be more accurate and precise to identify heart related diseases.

3.2.2: Possibility of new entrants

There is high possibility of new entrants as wearable deices in the current market. Researchers are studying and focusing on developing the ultimate product that can continuously monitor and update the users regarding their current heart status. People are more aware and doctors are unable to identify the heart status in few check-ups. So, there is a demand for such wearable devices that can continuously monitors the human heart status. Due to these, many medical institutes and researchers are developing newer devices that helps users to avoid devastating consequences. However, the time, resources and money are highly used for the development of such devices but there is high number of demand of such devices. so, there is high possibility for new entrants in the market.

3.2.3: Threat of substitutes

There is a possibility for threat of substitute because researchers are coming with newer ideas for continuous monitoring of heart. The device developed by Pinhole is also a substitute for other devices whose algorithm is weak to monitor heart rate. Previously ECG machines are used to check and monitor heart of a patient. These machines are huge, expensive to buy and not user friendly. So, the compact wearable devices are in demands where we have sensor chip in it which monitors the heart pulse. Unless and until, there is room for improvement, there is possibility of substitute product.

3.2.4:. Bargaining power of suppliers

The bargaining power of supplier depends upon the marketing strategy and target market of the company. We are expecting to go for 'Partnership' in target market. There's a possibility that the suppliers may have an upper hand while bargaining because we are getting suppliers of the partner company. However, if Pinhole decided to find the suppliers on their own might minimize the cost compared to of partners. The software of the device is developed by the Pinhole itself so, there is no problem on bargaining with the suppliers. But, we need hardware from the suppliers and there are various suppliers with different prices. So, Pinhole can choose the cheapest price for good quality of hardware.

3.2.5:. Bargaining power of buyers

In most business scenarios, buyers are considered as the most important factor determining the price of a product. These buyers are the end users of a product. If buyers are satisfied with the product of Pinhole, they can demand more according to their need. As Pinhole is planning to launch same product with various specifications according to the need and want of the consumer. If a buyer is health patient, s/he can purchase the device which have stronger algorithm and durability. If a person wants it for fitness measure the algorithm of the device will be of average level. According to the need of the buyer, Pinhole is using price differentiation strategy. So, the bargaining power won't be a challenging for Pinhole.

3.3: Market Size

The global wearable computing market will grow at a compound annual growth rate (CAGR) of 43.4% from around $5 billion forecast for 2013 to $9.2 billion in 2014 and more than $30.2 billion forecast for 2018.(42)

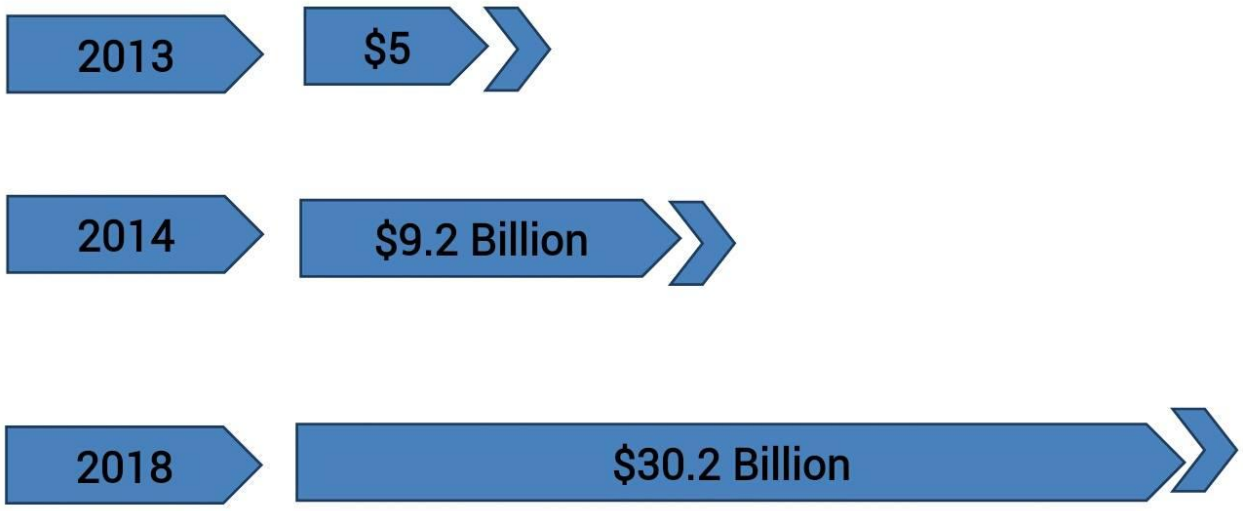

Figure 1. Market size and expectation of wearable devices

3.4: Market Segment

3.4.1: Medical and Health Segment

The potential user of wearable device for medical and health purposes is increasing day by day and the market growth is doubling in every three to four years. For the medical and health segment patient, a wearable device can collect information on heart pulse during different activities such as heart rate in stress level, working patterns, sleeping patterns and more. Hence, such a device provides better information of key insights of different heart parameters for doctors, nurses, physicians, caregivers and patient themselves. For example, a small device of diabetic's detection helps physician, caregivers and patients themselves to regulate their insulin level in a proper manner.

The wearable devices are providing opportunity for doctors to monitor and deliver care even outside of hospital. In the recent days, not only the doctors and nurses are experimenting and implementing with wearable technologies in their practice but also the health care worker are doing same. The use of wearable device allows them to become more precise and focus on the patients at all the time. The primary use of wearable devices in medical and health purposes is to get the vital heart information. That should be viable through its promptness and accuracy. So, the reliability of those devices is very critical. Hence, wearable device used in health and medical purpose should be clinically approved from the different heath regulatory organization.

Apart from medical care, the potential use of application of wearable device in health care is also vast. In recent days, the use of wearable device in health care is consider as the largest market segment. According to BCC Research, "The global health care market revenue for wearable devices is estimated to reach $1.1 billion in 2014 and grow to $2.9 billion by 2018"(42)

As per MaRS research library, the market demography is divided into four categories i.e., North America, European Union, Asian Pacific and Rest of the World. In 2014, the North America with 52% contribute the largest revenue from this market segment, whereas the rest of the world contribute the minimum revenue of 7%. European Union and Asian have moderate revenue with 26% AND 16% in the segment respectively. In 2018, North America will contribute 44% as

revenue and the rest of the world will contribute the increasing revenue of 11%. European union and Asian pacific will have moderate revenue of 25 % and 20% respectively.(42)

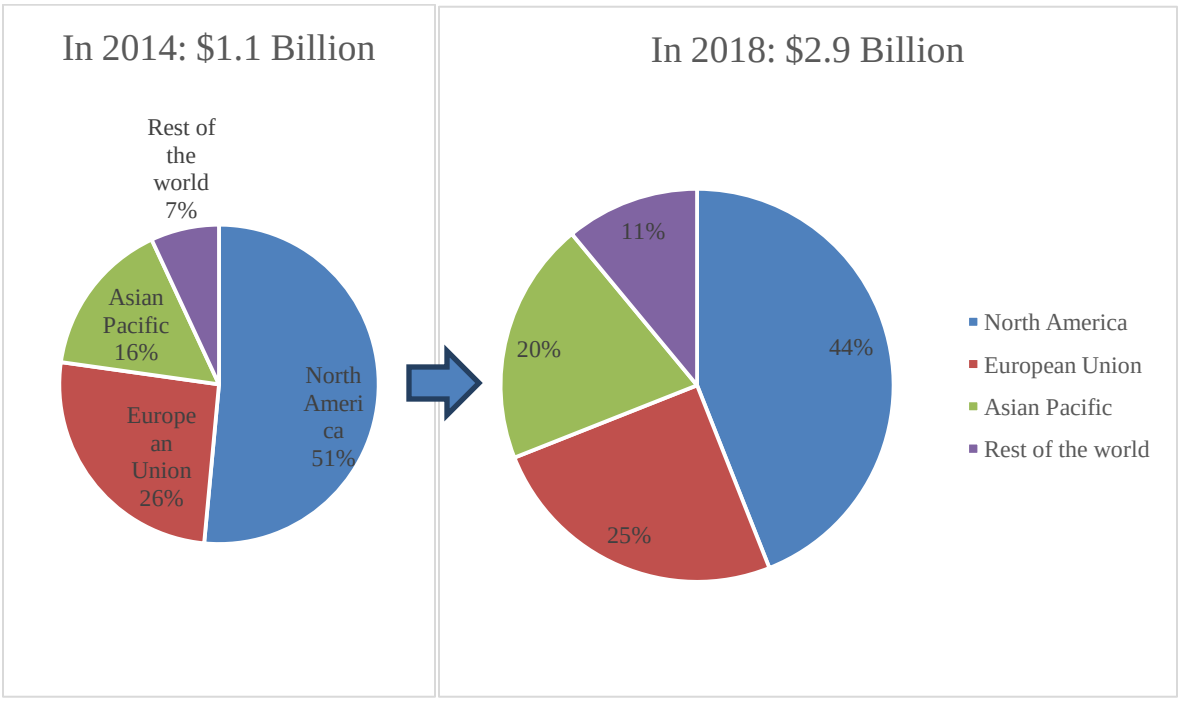

Figure 2. Market size of medical and health segment

3.4.2: Sports and Fitness Segment

The recent research shows the sports and fitness segment has greater potential to tap the market. The professional and amateur athlete is more health concise. The wearable devices for this market segment measure data such heart rate, pulse rate, breathing rate and much more. These devices can be simply design and can be customize to meets the demand of the health concise consumer such as professional, amateur athletes, sports coaches and family of athletes etc.

The health concise customer are keen interested such type of fitness wearable devices because of the precise heart information, deeper understanding of the heart rate and heart conditions. That will motivate them to know more about their heart and heart working process so that, they will recognize the necessary key steps and implement in their own way to improve their overall health condition.

In our research, we found there is hyper competition in sport and fitness segment. “The fitness and sports segment is currently experiencing fierce competition as companies like Nike, jawbone, fit bit, Philip and Samsung battle for space.” As per MaRS research, we found the health and fitness segment will increase from $2.4 billion in 2014 to $5.1billion in 2018 as shown in the figure below. As per MaRS research library. In 2014, the North America with 43% contributes the largest revenue from this market segment, whereas the rest of the world contributes the minimum revenue of 8%. European Union contributes second highest revenue of 38% and Asian pacific contributes revenue of 11%. Whereas in 2018, North America will contribute 41% as revenue and the rest of the world will contribute the increasing revenue of 11%. European Union and rest of world contribute revenue of 36% and 12% respectively.(42)

Figure 3. Market size of sports and fitness segment

3.5: SWOT Analysis

SWOT analysis shows the major issues and impacts of a product divided into four categories as; strength, weaknesses, opportunity and threat.

Strengths - accurate algorithm - continuous monitoring - health kit - compact and compatible	Weakness - no independent usage - only monitor heart pulse - trendy and design - costly -storage capacity - battery life
Opportunities - growing market - social contribution	Threats - competition - massive investment on technology - continuous research and development

Table 2: SWOT analysis of Pinhole

3.5.1: Strengths

Strengths are the internal aspects of the company which represents the advantages that the product have against other products. If we take internal aspects of Pinhole, there are several important factors that considered as assets for the company.

Algorithm

The software use in pinhole device measures the heart rate through continuous monitoring of blood flow and circulation in human body. The software consists of algorithm that gave pulse calculations that were consistently within a few beats per minute of those made by electrocardiograms (EKGs). It shows approximations of the time intervals between beats - a calculation used to pinpoint people who are at risk for cardiac events. (43) The software developed by the Pinhole has the algorithm that monitor the human body and have more frequent data which allows doctors to identify the accurate results.

Continuous monitoring

Heart diseases are not easy to identify and it takes longer time to pin-point if a person is having any heart related diseases. In such circumstances the device will continuously monitor the heart rate of a human body and record all the functioning, ups and downs, which later used to measure if there any risks or trouble with the person or not.

Health kit

The device will work as a health kit to its users. It record the heart beat, heart rate, blood pressure of a user which shows them their current health condition. It allows the users to access their data which can immediately share with their personal doctors and others.

Compact and compatible

The device is more compact as it comes in different shape and sizes. The users can choose as they have options like watch, wristband and ear rings. The sensor chip is compatible in all these products. So, user can choose what they want to wear.

It is made in such a way that it is compatible to all gender, age people. It is compatible to all aged people, children, teenage, adult, old etc. It is made so that it has no further allergies and reaction to the skin of the users.

3.5.2: Weakness

No independent usage

The device itself is incomplete. It needs a software program to identify whether the human heart is in any deficiency. Generally, to read the algorithm software is required which is accessible by the doctors. Can be read and known by the doctors.

Only monitor heart rate

The device is only suitable for measuring the heart rate of a person because its primary function is to monitor heart rate and to identify any malfunction in human heart. There are possibilities that the device can be used for multiple purposes. However, for now the device is only used for monitoring heart rate.

Trendy and Design

Now a day's people are more attracted towards the looks, design, color and features of a product. People wants their technological devices look more trendy and attractive. Pinhole is trying to work on the design features of a device. For different users, the importance may be different but to be competitive they need to look their device attractive with its outer look. However, it will take more time and resources for Pinhole to make their device attractive because of the size of the sensor chip and battery and storage.

Costly

The device will cost according to its performance. Customer can get various options to choose, if they need the device for measuring heart rate for medical purposes, the device will contain many specifications which turn out to be costly. And, if the customer wants to use the device for fitness purpose it might not be costly. So, it might be costly for certain group of customers.

Storage Capacity

Pinhole is working on the data storage of the device. The device can hold the data for couple of weeks and the user need to store data in other devices and empty the device so it can collect new data again. So, storage capacity will be challenging since, the device monitor every minute of a user/patient. The patient might use the device for rest of his life will certainly need larger data storage.

3.5.3: Opportunities

Growing market

As we have mentioned in the market size that the wearable devices will be $30.2 billion by year 2018. It is the reason why most of the companies are competing to gain more market share than others. The number has grown from $5 billion to $9.2 billion from year 2013 till 2015. The market will be growing more than thrice in just 3 years.

Social Contribution

Pinhole has developed a device that will add for the welfare of mankind. The product itself is a medical device that will contribute to make life of people more ease and predictable of the future heart related problems. This device increases the self-confidence on people to live their life normally as if they don't need to worry about their problems any more. The device will keep them informed about their health status regularly.

3.5.4:Threats

Competition

There is a massive competition for the market size of wearable devices. Many wearable devices are in use and had various functioning on the basis of their features. Most existed companies are improving their devices and trying to make multiple uses from the same device. However, many available products had different features than the Pinhole device, but there is possibility that other companies are improving and adding additional features as common as Pinhole device.

Because, most people are health and fitness oriented which lead them to the perfect wearable device.

Investment on technology

Most existed companies producing health and fitness oriented devices are the giant enterprises in the market. They are well aware of the market need and market size of such devices. They have more capital and resources and have capacity to invest large amount of money to turn the market on their favor. So, such massive investment from existed enterprises could be a bigger threat for a new company like Pinhole.

Research and Development

Increasing technological use and technological development is always a threat for companies whose product is technological based. It is clear that every passing year newer technologies are developed and attracting large number of people towards it. Continuous innovation and continuous research and development will help newer companies to develop more promising technology and device than Pinhole. So, it will always be a bigger threat that research and development will lead through the break through innovation and overlap the current existed technology.

3.6: Marketing Entry Strategy

As a result of our comprehensive market research so far, we are able to get key market insights so that, we can implement the best appropriate market entry strategy for Pinhole. A strategy is always important to stay competitive in the market. The success of start-up companies like pinhole is somehow depends on the market entry strategy.

First of all, according to the theoretical concept the start-up company as a directly entry mode requires bigger investment and risks, meanwhile it gives bigger control on operation and revenue. However, such mode is not appropriate for Pinhole in its initial stage. As pinhole has just started, don't have any good will in the market, don't have financial and operation resources

so joint venture and acquisition can be excluded. And also Lymbersky(44) has explained that "What countries to enter and when mainly depends on the financial resources of a company, the product life-cycle and the product itself." Hence, it is not appropriate at the moment to use the direct mode in marketing for internationalization. And also, Pinhole is still unknown about the target market due to the tough competition and customer behavior initial response towards its product could take time to analyze.

Moreover, Pinhole has unique algorithms specialize to monitor the heart rate, which can be patented and licensing, its innovation through other networks or company. Here, the both parties will have win- win situation so that Pinhole will be reward with certain percentages of the revenue and in return other network will use Pinhole algorithms. Hence, Licensing Pinhole's unique algorithms could give an edge over its rivals.

In contrast, theory accepts indirect modes via dealer ship or partnership, which is consider as less risky and resource committed mode. As there will be less control for Pinhole. But it can facilitate Pinhole to manage the local norms, system, culture, legal regulation and many other differences. This mode is highly beneficial to handle the logistic and operation in the local region. Therefore, the most appropriate entry strategy for Pinhole at the moment to enter the market will be through distributor.

In additional, Pinhole could have partnership approach to start sales activities in different part Europe and all around the world. Partnership will help Pinhole to grow at a decent pace. There is a proverb "one sheep to go, the rest will follow" so, It is very important to target the right customer in the very beginning. So that, partnership with the experience network could lead more convincing customer to the Pinhole's products, which can raise the sales significantly in the market in future.

Furthermore, the initial impression will definitely bring positive vibes influencing the next initiative. So that, Pinhole could approach to the well-established network and wide customer portfolio companies such as Apple, Samsung etc. for collaboration in future and get the opportunity to tap the market of one billion smart phone user.

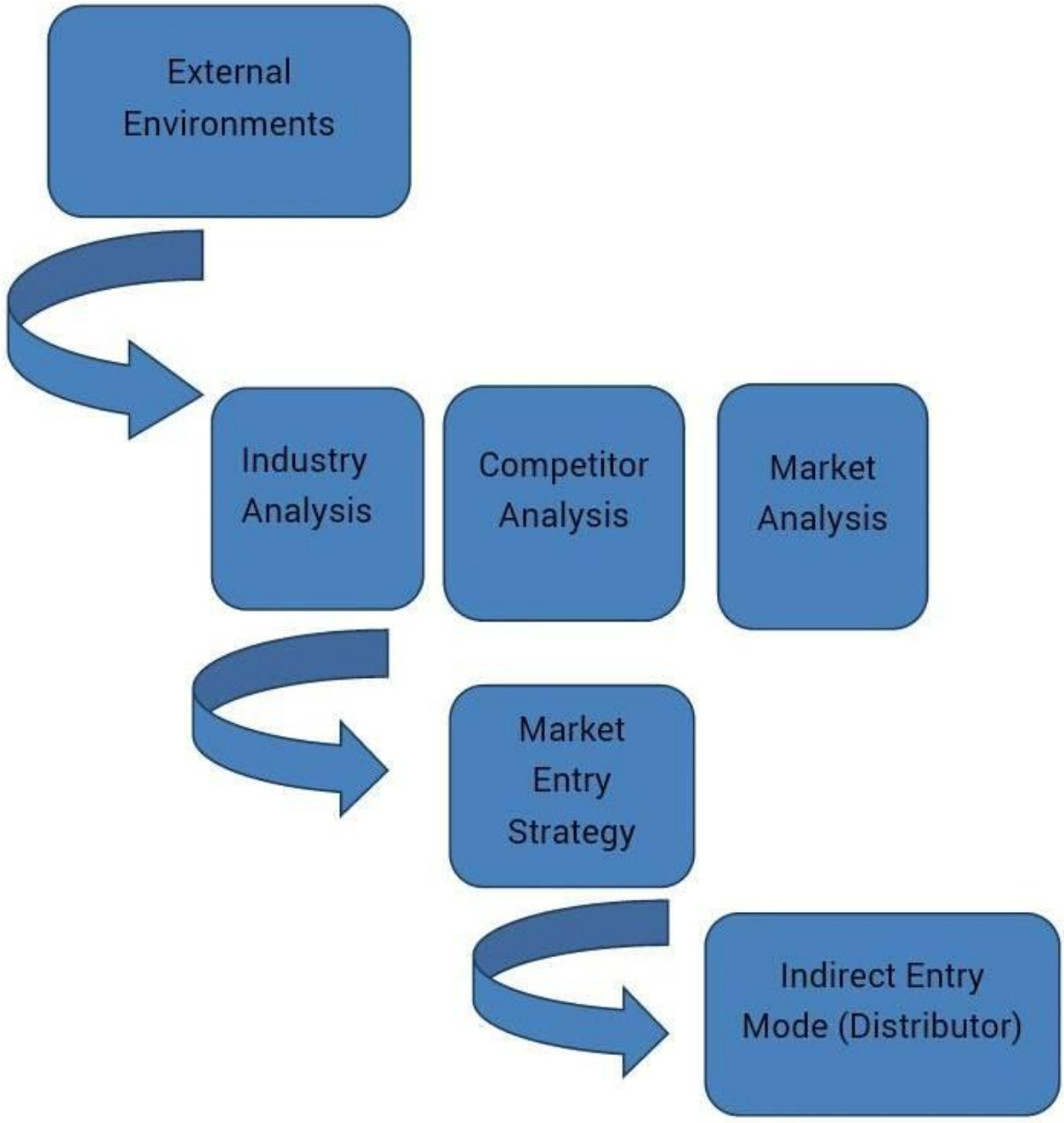

Figure 4. Indirect entry mode through distributor

3.7: Market Strategy Framework

Market strategy is the fundamental goal of increasing sales and achieving a sustainable competitive advantage.(45) Marketing strategy are basically the combination of marketing plan,

which is design to attain the marketing goals and objectives. A strategic plan can be constructed to identify business alternatives, establish challenging goals, determine the optimal marketing mix to attain these goals, and detail implementation.(46)

After a market research and external environment evaluation, we come up with a strategic plan as shown in the figure below. We develop a market strategy framework for Pinhole to monitor progress and for detail implementation of our plan. We have categories the frame work into three part i. market explores, ii. Market entry and market conquer with the detail time frame of 2 to 5 months, 5 months to 1.5 years and 1 year to 5 years respectively.

On the first part, we will do market research such as industry analysis, competitor analysis, market analysis, business model and business plan design, innovation, technical-economic feasibility.

Whereas on the second part, Pinhole will exercise for market entry so that we will allocate resource as per design, implement business plan, organize many industrial conference & workshops to show our product to the potential customer and distributors. In the meantime, we will come up with appropriate marketing strategy, sale strategy and commercialization process.

And finally at last on the market conquer; we will try to review of result, customer feedback and market response towards our product. We also try to attain the break-even point by increasing the sales and revenue. If necessary, we will update and re- designs the business plan for exponential growth and look for the potential partner for partnership and collaboration as well.

Figure 5 Market Strategy framework for Pinhole

3.8: Target Market

Based on Ashworth and Voogd's classification there are three basic segmentation strategies: a) concentrated strategy that focuses on one specific target market. The most important part of this implementation concerns the identification of the particular characteristics of the selected target market, in order for the provided city's image to meet the perspective image that this target market has for the selected cities, b) differentiated strategy, by choosing various target markets but also a different strategy of proceeding each of them and c) undifferentiated strategy, when target markets' treatment is the same for all, offering a stable process for each of them separately. (47)

The target market can be categorized on the basis of areas and can be separated on the basis of demographic, behavioral, psychographic, geographic etc. Pinhole is a small company for now and had limited resources and liability however, it has joined hands with different partners yet they are small in a big market. Pinhole can go for the direct marketing where the company can sell its product to the customers. It can buy customer database from hospitals, doctors where all the necessary information are available like name, email, address etc. There is also a possibility that Pinhole can go for mass marketing where it can address large number of audience. The objective of mass marketing is to broadcast a message which will reach to maximum customers. Pinhole could use different tools under mass marketing like television, newspaper, radio as means of communication. Concentrated marketing approach is another best option for Pinhole. In this concentrated approach, Pinhole can target some specific group of customer such as children, old age people, health conscious people, women etc.

Basically, Pinhole will target the small group size for its product. Small group size will be easy to monitor and analyze and feedback can be received individually. Pinhole is focusing and targeting the children with congenital heart disease inside Norway. They will be spending 1 to 2 years studying the device and its usefulness to such children.

4: BUSINESS PLAN

4.1: Executive Summary

This part, we will focus on evaluating the business opportunities for Pinhole. We have figure out the canvas business model so that, It will give a hindsight to develop a business plan, as in the figure in the business report.

In addition, we will briefly explain the key personnel and the management team on the 1st part of this business plan, with their background, skills profile and competencies.

Iit will help us figure out the market strategy framework and different marketing plans. We will also explain the development and operation plans of Pinhole in detail.

Furthermore, after analyzing and understanding the whole theme of different market parameters, we would able to make an overview of a business plan. Hence, we could explain the business model and its operations in details as in the business report.

And finally, based on target market of i .Children's with heart diseases, ii. Elder people with CVD disease and iii. Fitness house, we get the rough estimate of Pinhole's financial projection and income revenue with assumptions. We will further explain the capital needs, risks, proposed offering and the exit strategy in this report.

4.2: Pinhole's Mission & Vision

Mission Statement

The mission of Pinhole as a multifunctional medical device company is to develop low noise 1st generation PPG sensor multi-functional device for detailed observation of skin reflectivity. We assure customer and patient's prompt, continuous access of heart information in an understandable and effective way through our high quality medical device. We embrace the changing healthcare context and identify, seek & explore the newly developed integrated sensor modules that fit in our purpose. With the best user friendly and qualitative approach, we commit

to strengthen our position in the market as a market leader and a financially viable company through innovation and continuous improvement.

Vision Statement

The vision of the Pinhole is to recognize itself as a provider of specialized health care product with in the multifunctional medical device industries to improve the quality of life and to live longer.

4.3: Business Idea

According to Cardiac Exercise Research Group (CERG) at NTNU, over 30% of all Norwegians die from cardiovascular diseases (CVD).(26) CVD represents the leading cause of death around the globe.(48) Most likely everyone has a colleague or family member, or even suffering themselves from some form of heart related issue. Thus, in addition to the obvious motivation of marked position, we also have a strong personal interest in making this project a success. Current medical research acknowledges the importance of measuring continuous characteristics of heart performance in natural environment in addition to in-hospital survey and tests.(49)

The goal of this project is to develop a multifunctional heart-monitoring device. The device will be wearable (armband/watch/earring) to enable convenient and comfortable continuous monitoring of the heart performance of the subject of interest. Such a device will be able to assist people in monitoring and coordinating their lifestyle with respect to personal health condition, thus predicting and preventing possible health complications.

The heart condition may be evaluated from the electrical impulses that initiate the heartbeat to the effect the subsequent heart contraction have on the blood circulation. The heart is a central organ in our body and do display a variety of symptoms initiated by conditions all over the body. Thus, being able to assess the heart function of a person is a key to understanding the overall health of the person, and in particular to CVD.

Variations in blood pressure cause changes in the blood stream in our skin. The human eye cannot see these changes unless they are substantial (e.g. when a face turns pale during a blood pressure drop). Recent advances in sensor technology and signal processing have led to devices that measures blood pressure variations through observing small changes in skin reflectivity. Examples of such devices are a range of optical pulse watches that are on the marked already.(50)

Wearable Photoplethysmo Graphic (PPG) sensors, incorporated into the optical pulse watch, have improved considerably over the last decade. PPG sensors operate in two fundamental modes, transmittance and reflective. Most details of the underlying pressure pulse are seen in transmission mode PPG sensors, where light is transmitted through the tissue. However, the reflective mode PPG sensor, where reflected light from the skin is observed, is often preferred since they are easier and more comfortable to wear. In spite of recent advances there is still a need for further research to achieve good and reliable PPG sensors.(51)

To achieve this goal we need to team up experts on optical instruments and signal processing with medical experts that can interpret observed signals with body characteristics. In addition we need necessary optical hardware to map the properties, including variability of the skin reflectivity at various body locations and at different wavelengths.

In our team we have the necessary human and laboratory resources to expect an innovative sensor design, state of the art signal processing and medical knowledge that will lead to improved knowledge on how skin reflectivity changes relate to body characteristics.

We believe that together with our partners we are able to address the marked with products that meet the standards in quality and reliability that will be required for health tracking devices both for personal use and as a tool in medical care.

4.4: Management Team

Basically, it is an academic research project from university of Tromso. The project is currently working under the incubator of Norinorway in Tromso. This medical device company Pinhole consist a team of three key personal, including the inventor of this device.

4.4.1: Background and skills profile

Torsten Aslaksen is the inventor of this device. He is a Professor in Physic (optics). He has long experience in development of diverse optical instruments. For his PHD, he has designed and engineered set of cameras for Northern light surveillance. In the team he is responsible for sensor development and hardware design. He has designed and realized multispectral and hyper spectral instrument for imaging ground from an aircraft. He has a broad background in physic and particularly in interactions between matter and electromagnetic radiation, which is often a prerequisite for developing instrument tailored to the needs of customers.(52)

Vasyl Belyey is another key personnel of this company. He has a PHD degree in Physics and Mathematics from Leningrad State University, 1988. MS degree (Diploma with distinction) in Radio Physics from Kharkiv State University, 1982. He is responsible for software design and development. He has more than 30 years long research experiences lies in the field of ionospheric radio wave propagation (Institute of Radio Astronomy, Ukraine, Cornell University) and physics of upper atmosphere and ionosphere using incoherent scatter radars (University of Tromso, EISCAT from 2002 to 2014) with a focus on software development for data collection/ processing and computer simulations. Since 2005, he actively participated in the development of new generation incoherent scatter radar EISCAT-3D. He is a member of Norwegian National E3DN (EISCAT-3D Norway) consortium. He has skill competence in the physics of ionosphere, incoherent scatter radars, interferometric radar imaging, software development, data collection/ processing/ analysis.(52)

Oleksandra Bieliei is the Chief executive officer of this company. She is responsible to introduce this product in the market by representing and conducting seminars, industrial conferences and industrial exhibition programs etc, product evaluation, market viability and commercial potential, making strategic plan and business development plan and business model

for the market, sustainable revenue generation from this product to the stake holder and take this project to the next level. She has graduated MSC Business creation and entrepreneurship from University of Tromso and also Master in Management of Organizations from Kharkiv State University, Ukraine. She has experience of working as Marketing manager in " TIGI" professional hair care company and as a general manager in a start-up company. And also the teaching experience in University of Tromso as guest lecture.(52)

Name	Designation	Experience	Job Responsibility
Torsten Aslaksen	**Inventor & Co-founder**	Physic Professor (optics) Design & engineered on set of Telescopic camera Implementation of diverse optical instruments.	I. Optical sensor algorithm design II. Hardware design III. Prototype design
Vasyl Belyey	**Co-founder**	30 year's research experiences in the ionosphere radio wave propagation Software development & Implementation of data collection/ processing and computer simulations	I. Software design II. Data collection/ processing and computer simulation of this product
Oleksandra Bieliei	**CEO & Co-founder**	working as Marketing manager General manager in a start-	I. Introduce this Pinhole in the market by representing and conducting seminars, industrial conferences and industrial

		up company Teaching experience as guest lecture	exhibition programs etc, II. Making strategic plan and business development plan and business model for the market III. Sustainable revenue generation from this product to the stake holder and take this project to the next level IV. Delegate responsibilities and accountability to founders and stakeholders on the behave of Pinhole

Table 3: Key personnel of Pinhole

4.5: Organizational structure of the Pinhole

The organization chart is diagram showing graphically the relation of one official to another, or others of a company. It is also used to show the relation of one department to another, to others, or of one function of an organization to another, or others. This chart is valuable in that it enables one to visualize a complete organization, by means the picture it presents. (53)The Organization structure of Pinhole is given below, where the chart is categories into three different level. The Ist level is the authority level, that contain board of directors and CEO. The board of directors are responsible to make the rules and regulation in the company whereas, CEO is responsible to implement on the approvable of BOD. This level is the decision making and implementing regulations. The 2nd is the middle management i.e., CFO, Sales & Marketing Manager, Operation Manager & Technical Manager. They directly report to the CEO. And the 3rd level is the Admin & Finance officers and Service & Maintenance officers. They are reporting to their respective manager as shown in the figure below.

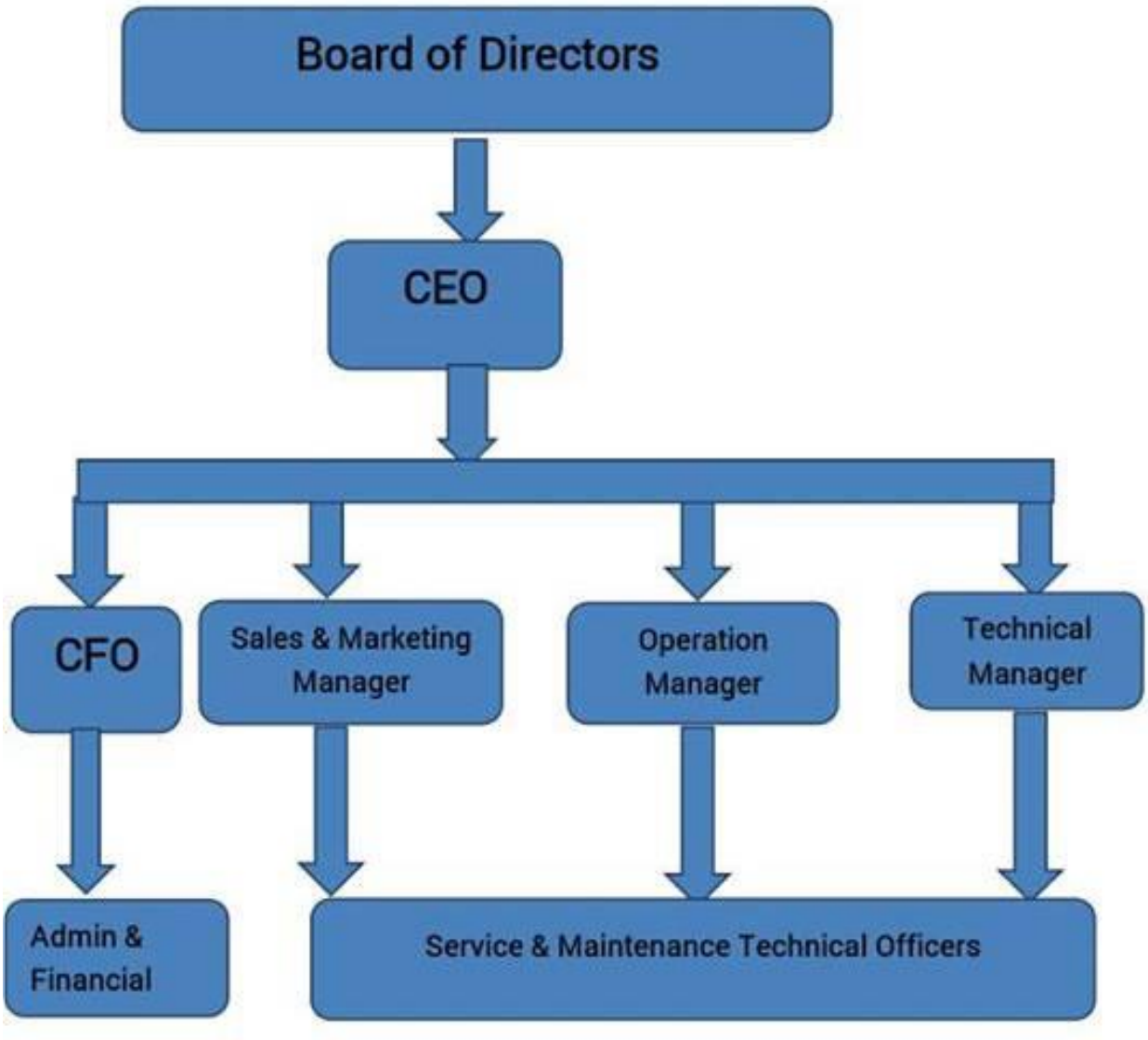

Figure 6. Organization structure of Pinhole

4.6: Development and Operation Plans

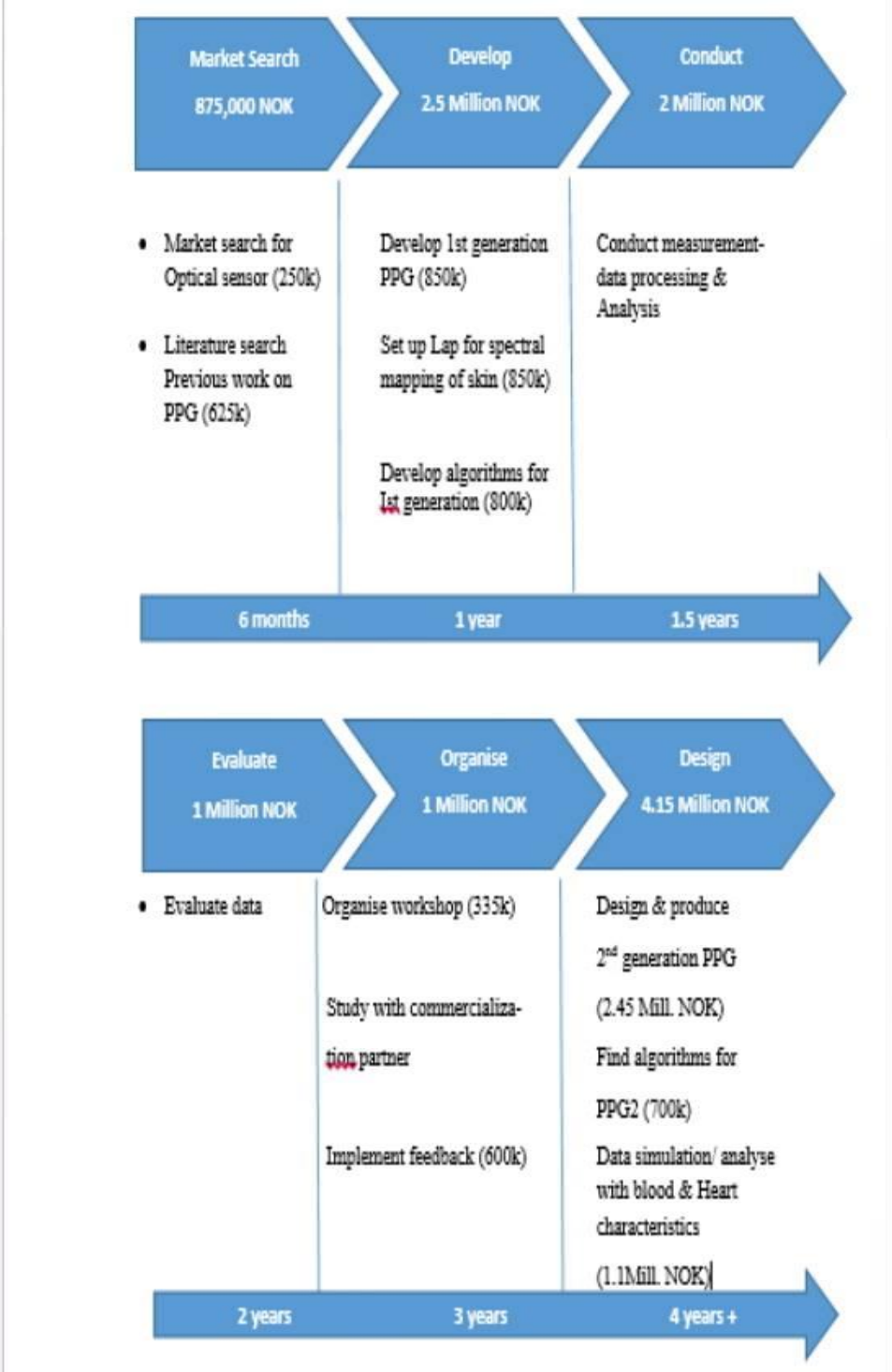

Figure 7. Development & operational plan of Pinhole

4.7: The Market

The market for wearable devices is growing rapidly. These wearable devices are smart headsets, smart glasses, activity monitors, action cameras, smart watches and many more. Wearable sensor market will expand seven times in 5 years unexceptionally. Driven by rising demand for fitness and health monitoring features as well as by improved user interfaces, shipments of sensors used in wearable electronic devices will rise by **a** factor of seven from 2013 through 2019, according to IHS Technology. The worldwide market for sensors in wearable's will expand to 466 million units in 2019, up from 67 million in 2013. Shipments of sensors will climb much more quickly than the market for the wearable devices themselves. Wearable devices will increase to 135 million units in 2019, less than three times the total of 50 million in 2013.(54)

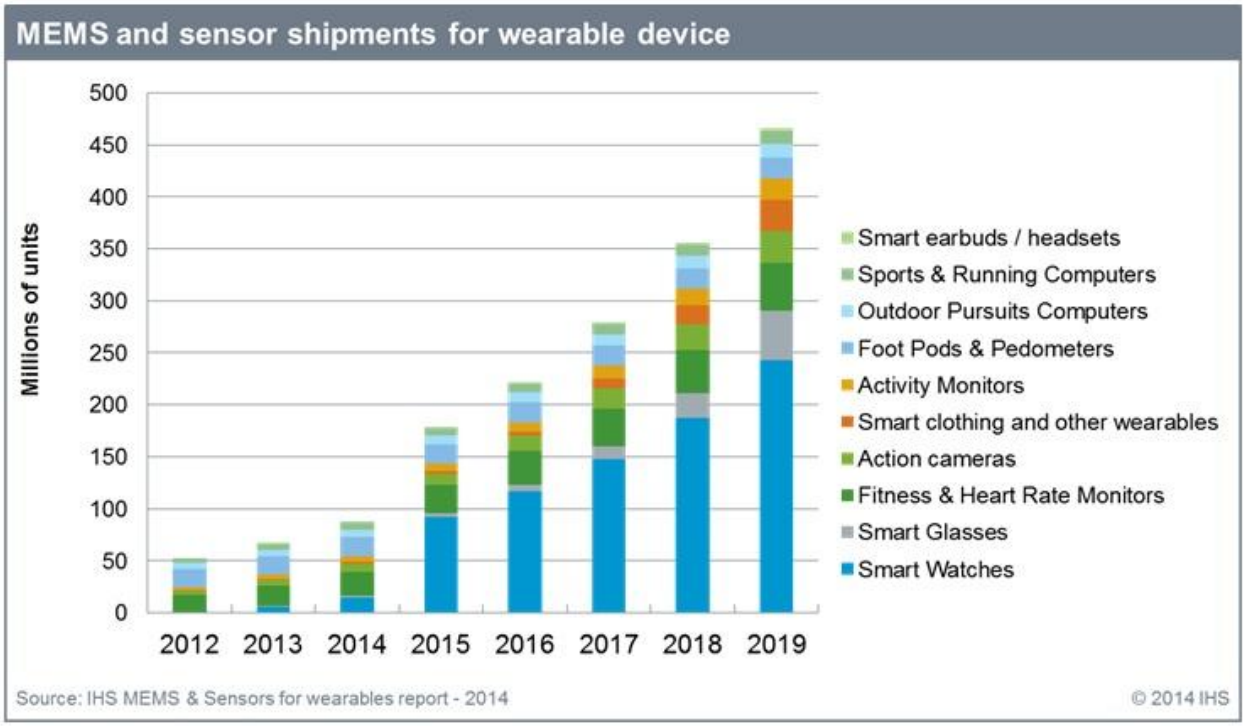

Figure 8. MEMS and sensor shipments for wearable devices

The figure indicates that the market for activity monitors are growing in smaller rate from year 2012 to year 2016, but the market will grow in multiplication figure from year 2017 till 2019. We can see that smart watches are increasing rapidly than any other wearable devices. If pinhole

software will be designed as watch or even integrated with smart watches will give gigantic market opportunity.

4.8: Competitor Analysis

4.8.1: Porter's 5 Forces Model

4.8.1.1: Bargaining Power of Buyers

Buyers are the ultimate consumers and demand of the product largely depends on the consumption of the product. If buyers are satisfied with the product of Pinhole, they can demand more according to their need. Pinhole is planning to launch same product with various specifications according to the need and want of the consumer. If a buyer is health patient, s/he can purchase the device which has stronger algorithm and durability. If a person wants it for fitness measure the algorithm of the device will be of average level. According to the need of the buyer, Pinhole is using price differentiation strategy. So, the bargaining power won't be challenging for Pinhole products with range.

4.8.4.2: Threat of Potential New Entrants

There is always a high risk or possibility of threat in business world specially when your product has technological advancement. Massive investment on research and development leads to newer technological development which has more features, improved functions, user friendly and attractive design.

San Francisco based Fitbit company had launched its first product in 2009 which has software element to counting steps, allowing users to view their progress through Fitbit's website or mobile app. After five years, it is developing heart rate tracking as a way to add value to its consumer health products, with plans to release two wearable early next year that will read heart rate through the wrist. And Fitbit is hardly alone: Jawbone, Intel, Motorola, Samsung, LG Electronics, Microsoft and Apple are part of a growing list of companies that will release or already have shipped wearable tech products with heart-rate sensors.(55)

4.8.4.3: Threat of Substitute

Substitute of a product doesn't always mean a complete replacement but also a partly replacement of product. Pinhole is developing a wearable device with sensor in it which continuously monitors the heart rate. In a physical form the device can be wore on hand as a watch, ring in a finger and ear ring in ears. Different companies are developing a device that can be attached in a cloth which is direct in contact with upper chest of the heart and these devices shows promising results. As technological development there's a high possibility of substitute product of Pinhole in coming future.

4.8.4.4: Bargaining Power of Suppliers

Basically, suppliers are those who supply all the necessary materials that required for the completion of the product. In Pinhole, software and hardware are the two major sources needed to develop a product. The software is developed by the owner himself so there won't be any problem regarding the software part. However, the device need hardware for its outlook structure which is been supplied by the reliable suppliers. There are number of companies producing the hardware parts and Pinhole has many options to select the best product in cheaper prices among the suppliers. So in such scenario, we can say that suppliers have less bargaining power.

4.8.4.5: Competitive Rivalry

Competition is a major challenge that might be faced by Pinhole because of the newer companies are developing similar products and already existed company are also improving their product because of great market opportunity. There is a possibility of 'Price War' among the companies, as customers prefer cheaper prices. However, the device of Pinhole gives accurate results among its competitor products but due to continuous research and development and advance technology there is a probability that other company will come u with similar results or much better. Rigorous promotion like sales promotion and higher spending on advertising could be the reason for competitive rivalry. Companies like fitbit, Predictor, are already well established in the real market and have massive investment on advertisement which helps to attract the users in the first place. After using the product if customer were satisfied they will stick with the company and its

product as loyal customer and leads to mouth to mouth marketing which is a better strategy to bring more customers in their company. So, it can be said that there will be intense competitive rivalry among the Pinhole and other companies for the market and market share.

4.9: Business Plan

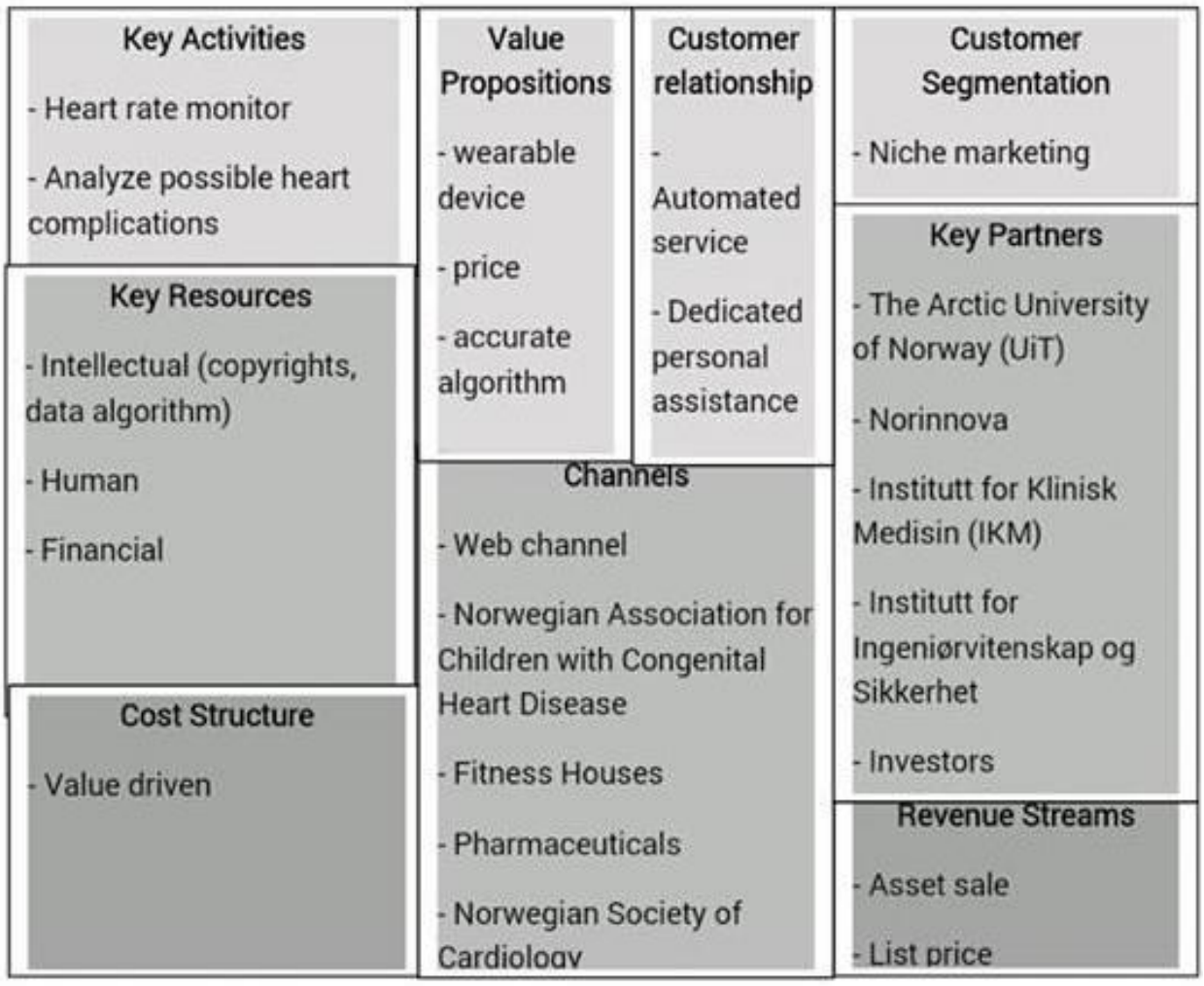

Figure 9. Business Plan of Pinhole

4.9.1: Customer Segmentation

Customers are the key person for whom the entire device is been developed. The device developed by Pinhole can be used by everyone since it does no harm but it makes people feel safe. There are various possibilities where the Pinhole can target its core customers such as heart patients, normal patients whose heart might be at risk of other diseases, fitness and sports etc. In our business plan, we are focusing more on the niche marketing where we have selected the children with heart diseases. It may sound absurd that such big company is targeting such a small group of customer. However, we are expecting the result to come in favor of Pinhole.

Norwegian Association of Children is the organization that will be helping Pinhole to test its device and see the result from it. Pinhole device shows a promising result in its function now it is time to test it in real market and to see whether the product will be promising in larger market. More than 10000 children in Norway are affected by the Cardio Vascular Diseases and are looking for the solution to monitor their health. So, Pinhole present its device to monitor are minimize future complication.

4.9.2: Value Propositions

Pinhole is offering a device to its customers, which can be wearable as a watch, ring or ear rings. These devices continuously monitors your heart rate because most diseases will have impact in your heart rate and a user will know whether he is in a normal state or need some medical attention. This wearable device will make it users more safe and confident as they knew the device will warn them if any problems might affect them.

The price of this device is a good value propositions for its customer because Pinhole will have different level of wearable devices according to the need of the customer. If a customer is a heart patient and need frequent monitoring than they can buy a device with superior specifications and if a user needs this device for fitness and sports purpose he can buy device with normal specifications. These specifications will determine the price of the device.

The algorithm used in the device reads the heart beat of a user and give precise information whether the person need some health assistance or not. Since the algorithm is accurate, user do not need to hesitate on the result provided by the device and act accordingly.

4.9.3: Channels

Channels are the means used to deliver the product and service to the end consumer. Pinhole has various channels to sell its device to its customers. Web channels are one of the best means to educate why this device is unique than others. People may find all the information they want in the web channels such as product information, price, features etc. However, Pinhole is working on web channels as it is in under construction but soon it will be available for everyone.

Norwegian Association for Children with Congenital Heart Disease is a organization helping Pinhole to test its device among the children who are in need of such device. It's a joint effort where Pinhole can use its device to monitor and identify the health status of the children and the Association will be able to cure and prevent hazardous situation in near future.

Fitness houses

Most people are fitness conscious these days and are spending lots of money on health and fitness. There are more than 470 fitness centre in Norway with nearly 0.1 million members. Most of these people use different applications or devices to monitor their movement, heartbeat, pressure and other but none of them are sure that what consequences might be if their heartbeat exceeds than normal. In such circumstances the device of Pinhole can give them current status of their health.

Pharmaceuticals

Pharmaceuticals are the place where such medical devices can be bought under the prescription of doctors and will be easy to find by the patients. These devices can also be bought without doctor consent as it can be used by any person but these pharmaceuticals could be a major place where the devices could be sold.

4.9.4: Customer Relationship

Pinhole will sell its device to its customers so, it's a personal assistance relationship where the customers can enquiry about the device, know its benefits after using it. This method will be more direct towards customers since, the company and the customer will come to an face to face interaction. Even if there will be channels such as distributors and retailers, they can pass the information Pinhole wants to deliver to its customers and customers can query which can be later answered by the company or the responsible parties.

Since, it is more like a medical device it has greater contributions to the society and community. Pinhole is currently interacting and working with 'Norwegian Association for Children for Congenital Heart Disease' where they can interact directly with the parents of effected children. In such platforms, knowledge is allocated and shared to solve problems and issues in different ways with different users.

4.9.5: Revenue Streams

The only source of revenue streams of Pinhole is from an Asset sale. Pinhole will sell its device to its customers which will be the only major source of revenue for the company. Pinhole will charge different price range according to the need and demand of the users. The price of the device will cost 2000 Nok for the users who are affected from severe heart diseases and have some heart related issues and 1300 Nok for those users who are fitness and health conscious.

4.9.6: Key Resources

The major key resources of Pinhole are Intellectual right, human and financial resources. These resources help to create value for Pinhole's customer. Pinhole strongest suit is its algorithm which reads the heart beat and gives the accurate results from its reading. These algorithm help its users to know their exact heart state. There are three major persons who had given a new direction to the company. These human resources succeeded in developing a multi-functional device and sooner they would have additional resource person to take the company into newer heights facing various challenges.

4.9.7: Key Activities

The major key activities of Pinhole device is to monitor the heart rate of a human body and read the patterns whether they are normal or not. This device is equipped with sensor chip which has an algorithm software that measures the heart beat and heart rate. When human body has more than average fluctuations or huge gap in heart beat than normal will result in to heart failures. So, to prevent human from such heart failures this device monitors the heart rate and warns the users if they need any precautions or medical attention.

As this device monitors the heart rate which in further the device analyze the data read by the sensor. These collected data by the algorithm of the device will be analyzed further and gives the status report of the heart which can be used to avoid possible heart complications of the users.

4.9.8: Key Partnership

Pinhole is working with different partners. As a matter of fact, Pinhole alone cannot develop the device on its own in short period and with limited resources. So it increase its areas and opportunities it has join its hand with Norinnova. Norinnova help in commercialization of technology and research-based innovations. Their main instruments are expertise, contacts, office and capital.(56) Pinhole is also working with Institutt for Klinisk Medisin (IKM), Norges Arktiske Universitett. This institute has two main areas of research and teaching. IKM's research is angled towards translational clinical research as a starting point. Continuing education for doctors is a task where IKM employees participate as tutors and teaching. (57) Pinhole is also working with Institutt for Ingeniørvitenskap og Sikkerhet which is also a department of Norges Arktiske Universitett, UiT.

4.9.9: Cost Structure

Pinhole's device gives higher value to its users than the cost. As a matter of fact, the device will help the users to be safe and confident about themselves. Pinhole understands the value of life and importance of your well being with your family. So, they are offering the device in moderate prices compared to that this device can actually do.

4.10: Financial Plan

4.10.1: Cost estimates

According to the Project Description of Pinhole, the following cost expenditures were occurred from the establishment of the company. The cost incurred from the raw development of an idea up to the prototype. Each cost is categorized under the same year it occurred.

Cost Occurred					
S.No.	Particular	2012 (Nok)	2013 (Nok)	2014 (Nok)	2015 (Nok)
1	Market Search	875,000	-	-	-
2	Develop first generation PPG	2,500,000	-	-	-
3	Data processing and analysis	-	2,000,000	-	-
4	Data evaluate	-	1,000,000	-	-
5	Organize Workshop/Seminar	-	-	1000,000	-
6	Design and Produce second generation PPG	-	-	-	4,150,000
7	Total	3,375,000	3,000,000	1,000,000	4,150,000

Table 4: Cost occurred of Pinhole

Beside the cost already incurred in Pinhole for its product development. The following cost will occur in coming years when it will virtually launch its product in the real market.

Cost Estimates in future						
S.No.	Particular	2016 (Nok)	2017 (Nok)	2018 (Nok)	2019 (Nok)	2020 (Nok)
1	Repair and Maintenance	400,000	500,000	800,000	1,000,000	1,500,000
2	Salary	2,500,000	3,200,000	5,000,000	6,000,000	7,000,000
3	Office Expenses	400,000	500,000	1,050,000	1,100,000	2,500,000
4	Sales and Marketing	1,000,000	1,100,000	3,000,000	4,000,000	6,000,000
6	Miscellaneous	700,000	700,000	1,000,000	1,000,000	1,350,000
7	Total	5,000,000	6,000,000	10,850,000	13,100,000	18,350,000

Table 5: **Future Cost estimate of Pinhole**

Assumption: Year 2016 and 2017, Pinhole will expense inside Norway. similarly, in year 2018 and 2019, it will expense inside Scandinavian countries and in year 2012, it will expense in entire Europe.

4.10.2: Revenue Estimates

4.10.2.1: S ales

Pinhole will sell its device to its customers in two different prices. The device specially designed for the heart diseases patients will cost 2000 nok and will cost 1300 nok for the regular users who are health and fitness conscious.

Country	Revenue from Sales					
		2016 (Nok)	2017 (Nok)	2018 (Nok)	2019 (Nok)	2020 (Nok)
Norway	**Children with heart disease**	900,000	990,000	1,089,000	1,197,900	1,317,690
	Elderly people	2,800,000	3,080,000	3,388,000	3,726,800	4,099,480
	Fitness Houses/Club	764,400	840,840	924,924	1,017,416	1,119,158
Scandinavian	**Children with heart disease**	-	-	5,200,000	5,720,000	6,292,000
	Elderly people	-	-	16,000,000	17,600,000	19,360,000
	Fitness Houses/Club	-	-	10,400,000	11,440,000	12,584,000
Total		4,464,400	4,910,840	37,001,924	40,708,116	44,772,328

Table 6: Revenue from Sales of Pinhole

Assumptions:

1. According to NACCHD, 9000 children are affected with heart disease out of which 5% will purchase the device cost 2000 Nok, it results into 900,000 Nok.

2. Nearly 28,000 elderly people are affected from Heart disease out of which 5% will purchase the device cost 200 Nok, it results into 2,800,000 Nok

3. Total number fitness houses are 470 with more than 500 members, out of which 5% of fitness houses and 5% of members will use purchase the device cost 1300 Nok, it results into 764,400 Nok.

4. Every year the sales margin will increase by 10% of previous year sales for Norway.

5. Nearly 26,000 children are affected from heart diseases in Scandinavian country (excluding Norway), out of which 10% of children will purchase the device of pinhole cost 2000 Nok, it result into 5,200,000 Nok.

6. Nearly 80,000 elderly people are affected from heart diseases in Scandinavian country, out of which 10% will purchase the device of pinhole cost 2000 Nok, it results into 16,000,000 Nok.

7. Total number fitness houses in Scandinavian country are 1,600 with more than 500 members, out of which 10% of fitness houses and 10% of members will use purchase the device cost 1300 Nok, it results into 10,400,000 Nok.

8. Every year the sales margin will increase by 10% of previous year sales for Scandinavian country.

4.10.3 Capital needs

Cash flow(Excluding VAT, NOK)					
	2016	**2017**	**2018**	**2019**	**2020**
Starting cash	**2,500,000**	**1,964,400**	**875240**	**27,027,164**	**54,635,280**
Cash in	4,464,400	4,910,840	37,001,924	40,708,116	44,772,328
Cash out	**5,000,000**	6,000,000	10,850,000	13,100,000	18,350,000
Total	**(535,600)**	**(1,089,160)**	**26,151,924**	**27,608,116**	**26,422,328**
Fund Needed	**-**	**-**	**-**	**-**	**-**
Ending Cash (Free Cash flow)	**1,964,400**	**875240**	**27,027,164**	**54,635,280**	**81,057,608**

Table 7: Cash flow (Capital need) of Pinhole

4.10.4: Critical risks

Risk	Probability	Impact	Effect	Mitigations
Intellectual property rights	Medium	High	Infringement of others IPR- Challenging our FTO	IPR lawyer to make sure future methods has the FTO
Investors	Medium	High	Development of the most improved PPG sensor	Individual private investors can be targeted
Sales	Medium	Medium	Bankruptcy due to low sales	Effective marketing promotions

Table 8: Risk analysis of Pinhole

4.10.5: Proposed Offering

	Data	Explanation
PV for 5 years	**31,173,051 NOK**	Present value for 5 years from 2016 to 2020. Formula: $PV = \sum_{1}^{n} FV/(1+r)^{n}$ (58) FV=Free cash flow of each time period; n=time period, r=Discounted rate
PV after year 5	**29,354,195 NOK**	Present Value after year 5 which is from year 2020 to the future. Formula: $PV = (C_1/(r-g))/(1+r)^{n}$ C_1=Free Cash Flow of year 2020 r=Discounted rate g=Yearly growth rate
Firm Value	**60,527,247 NOK**	Total present value for year 2016 to the future which is
Discount rate (r)	**50%**	Discount rate for mature companies is 10%-25%, for discount rate for start-ups is higher because risks are higher. In the stage of start-ups seeking money is 50–100%; for early start-ups stage is 40–60%; for late start-ups stage is 30–50%.(59)
Yearly growth rate (g)	**10%**	Estimated yearly growth rate for Pinhole is 10%.

Table 9: Proposed offering of Pinhole

4.11: Exit Strategies

It is obvious when you are going to start a new venture there could be different situations one could face at different times and in past we have seen all the success stories going around the world. They are ready for every situation. Whether it's a success or failure. And to conquer a debacle or failure one should always have some exit strategies or plans.

In this section we will look into different options which would be helpful during different phases. And these options usually depend on future goals, once you are going to achieve them the next step should be to make them aligned with your planned exit strategies. Usually what we do is to wait till you are on threshold and then you think about planning the exit, but to be successful it should be done as a succession plan, or a successful transition.

While considering exit strategies for Pinhole we would like to discuss the following routes.

4.11.1: Merger & Acquisition (M&A)

M&A is usually done in a market where competition is too high and one cannot survive entirely on its own so one company can merge with another with similar goals or being bought by a larger company. In case of pinhole this strategy would be ideal as they are already considering a partnership with some sports and fitness manufactures on one side, while medical device making companies are also interested in partnership with them.

4.11.2. Initial Public Offering (IPO)

There was a time when IPO was the real big thing in the market to get rich in rapid way but after the Internet bubble burst in the year 2000, the IPO rate has declined every year until 2010, and is now at about 15%. So this approach to start-ups in current situation won't be an ideal thing to do and we will not recommend pinhole to take this up. As then more time would be spent on selling the company, not running it.(60)

4.11.3: Sell the Company

As it's clear from the title that this is the last stop. Like absolute end, either you are on top of your game or you are suffering badly. From very beginning, you build sales and brand value to get the attention of potential suitors. You may have predetermined a level of profit at which you begin to market the company. For Pinhole this strategy is not solution right now as they have invested so much time and efforts into this project. It's the most difficult job of building a brand that a competitor or conglomerate will see your company as a good fit to its long-term strategy. And right now Pinhole is doing this to build the rand name in the market. While if things go wrong then acquisition is one of the most common exit strategies.(61)

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APPENDIX

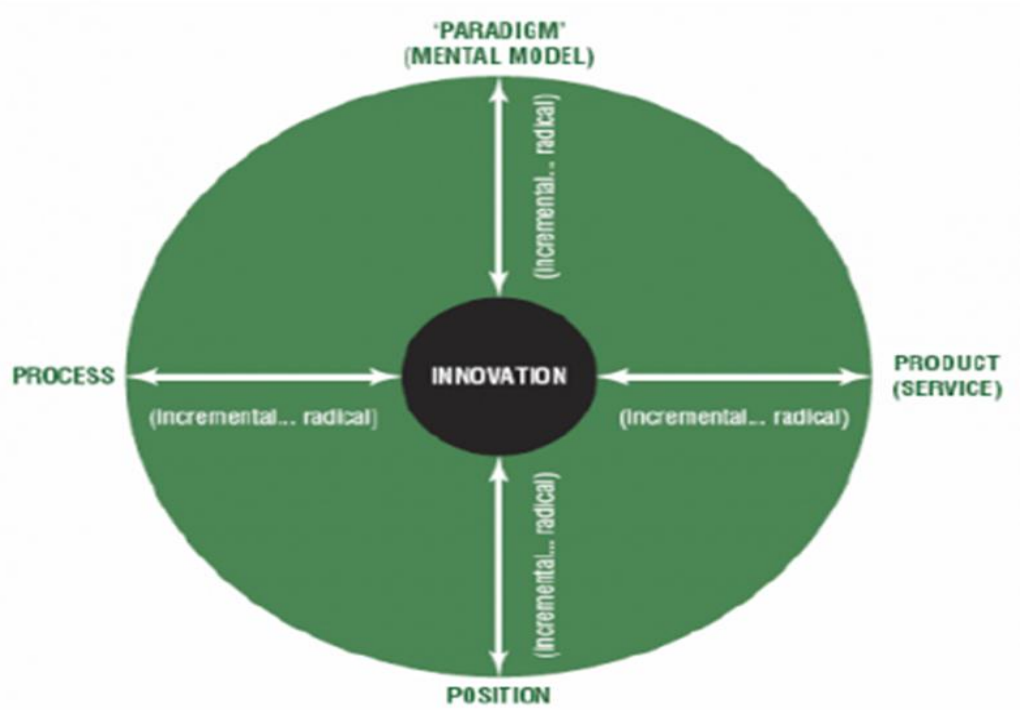
A.


Market
Developing
Radical
Incremental
Competence
Developing
Degree of external 'newness'
New to the market
New to the firm only
Existing skills/competences
New skills/competences
Degree of internal 'newness'

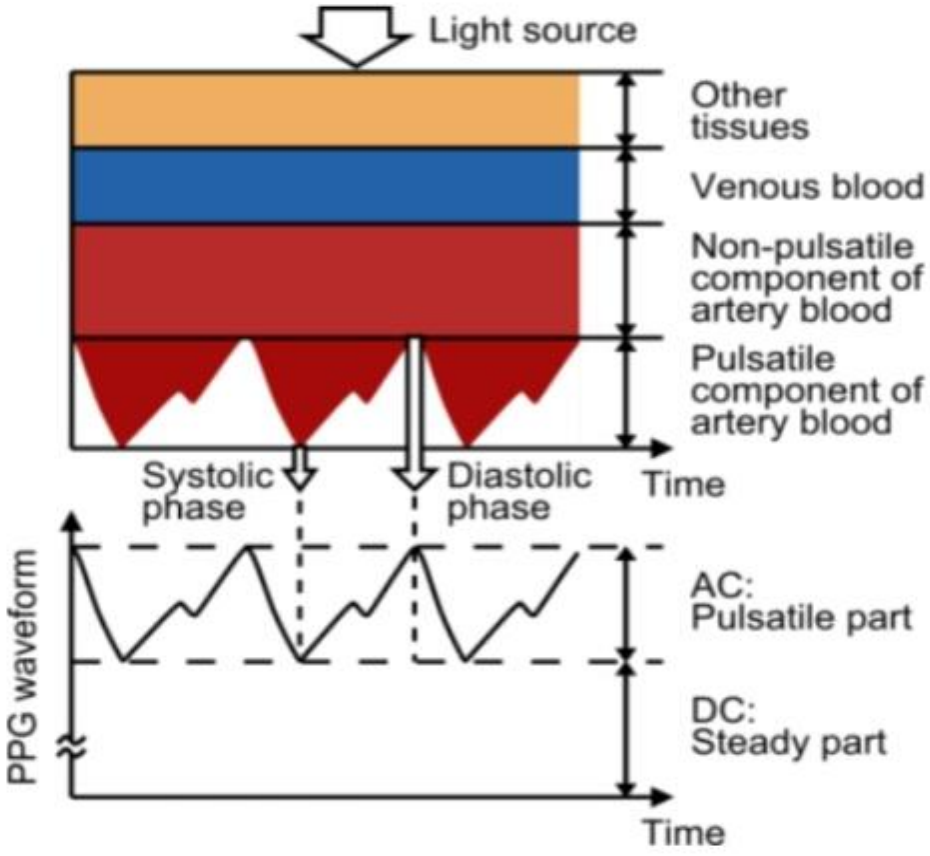
B. SWOT Analysis Framework

Source: Friend and Zehle, 2009

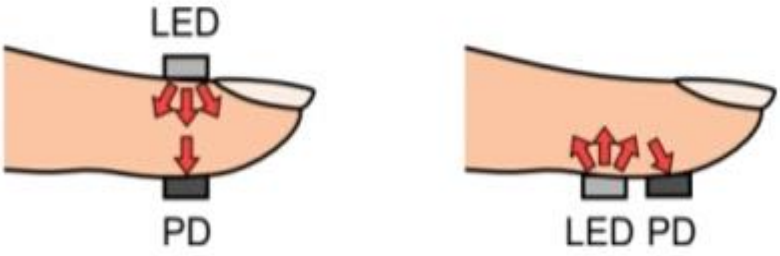
C.



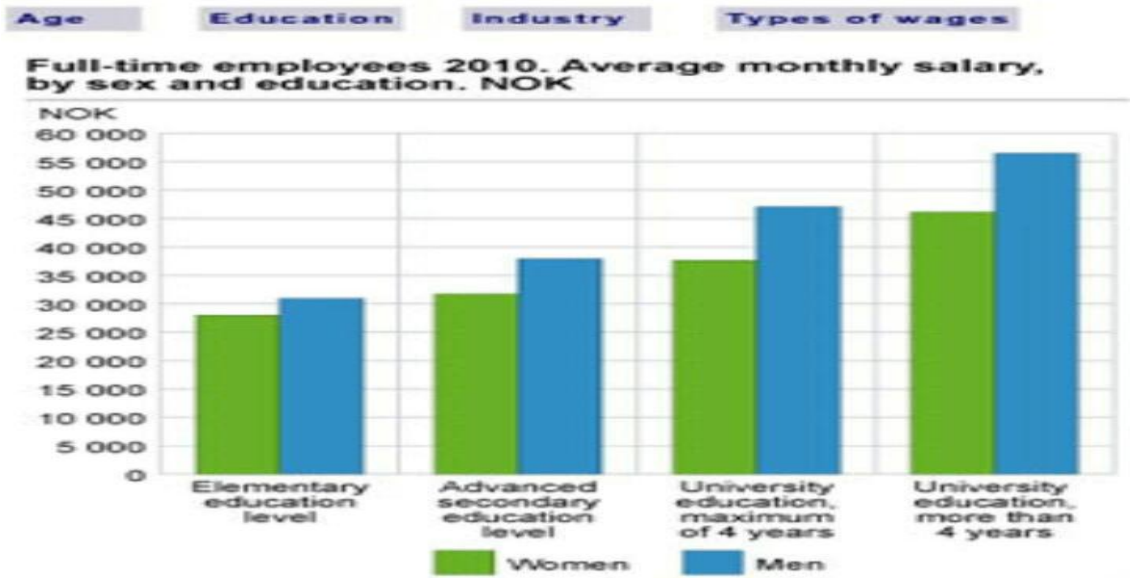
D. Variation in light attenuation by tissue



E. Light- emitting diode (LED) and photo detector (PD) placement for transmission- and reflectance-mode photoplethysmography (PPG)



F. Average monthly salary by sex and education in Norwegian krone.



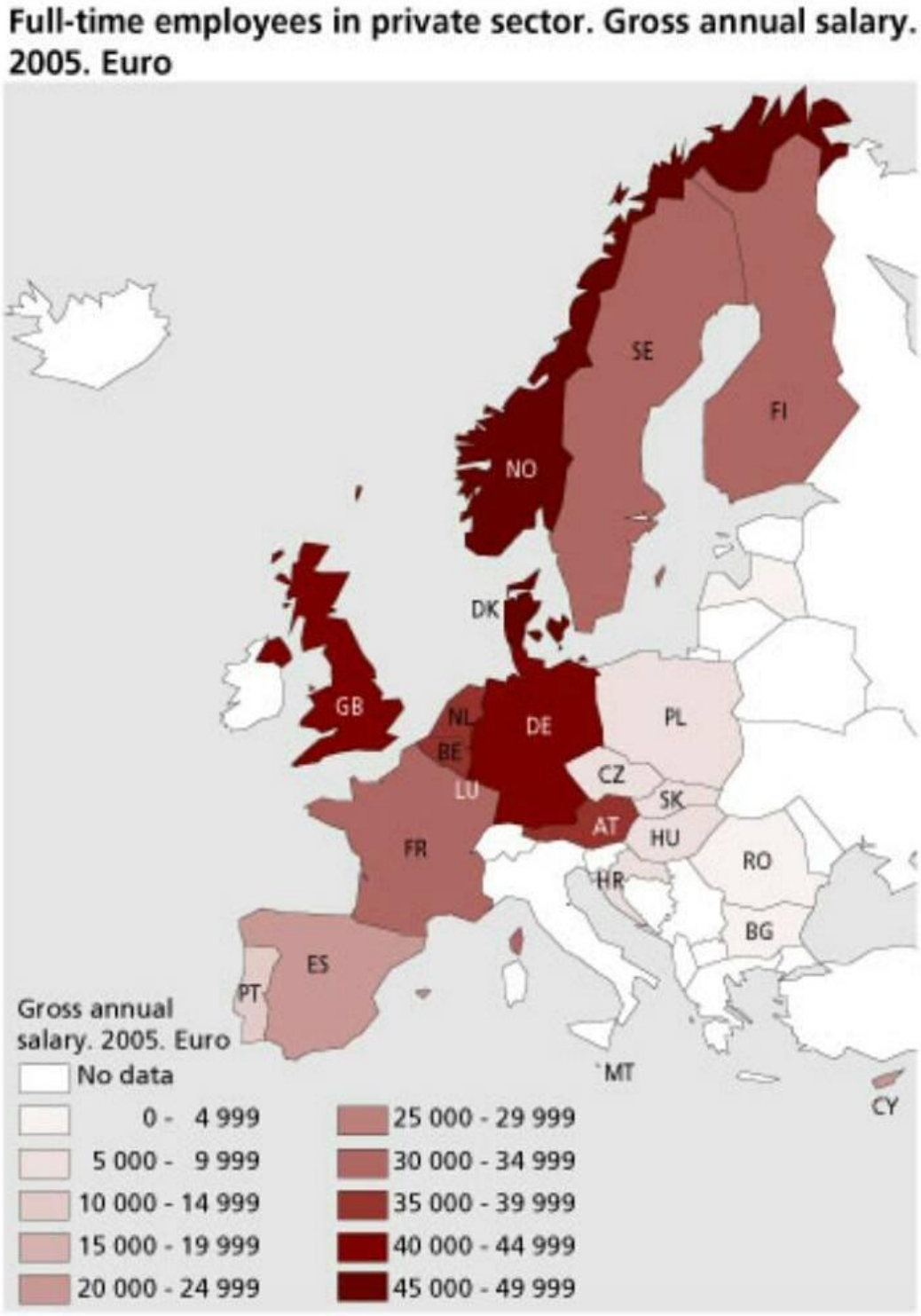
G. Norway overview for political factor

Norway Overview

RISK RATINGS	Current Rating	Current Score	Previous Rating	Previous Score
Overall assessment	A	13	A	14
Security risk	A	0	A	0
Political stability risk	A	0	A	0
Government effectiveness risk	A	7	A	7
Legal & regulatory risk	A	13	A	13
Macroeconomic risk	B	40	B	40
Foreign trade & payments risk	A	7	A	18
Tax policy risk	A	13	A	13
Labour market risk	B	32	B	32
Financial risk	A	8	A	8
Infrastructure risk	A	9	A	9

Note: E=most risky; 100=most risky.

H. Full time employees in private sector for economic factor



I. Mortality for Cardio Vascular Diseases

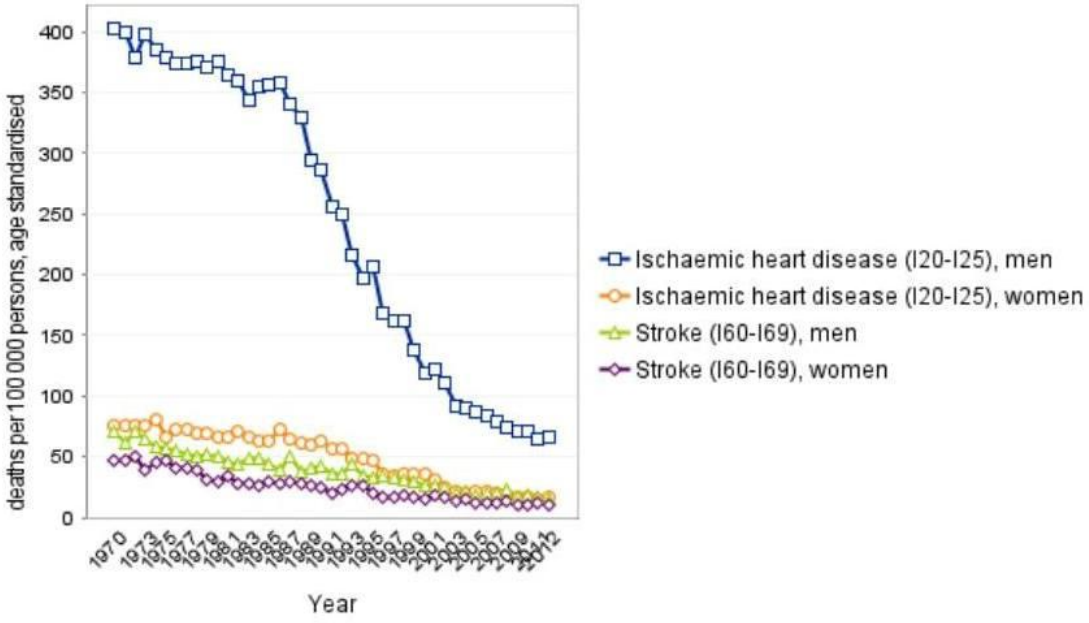
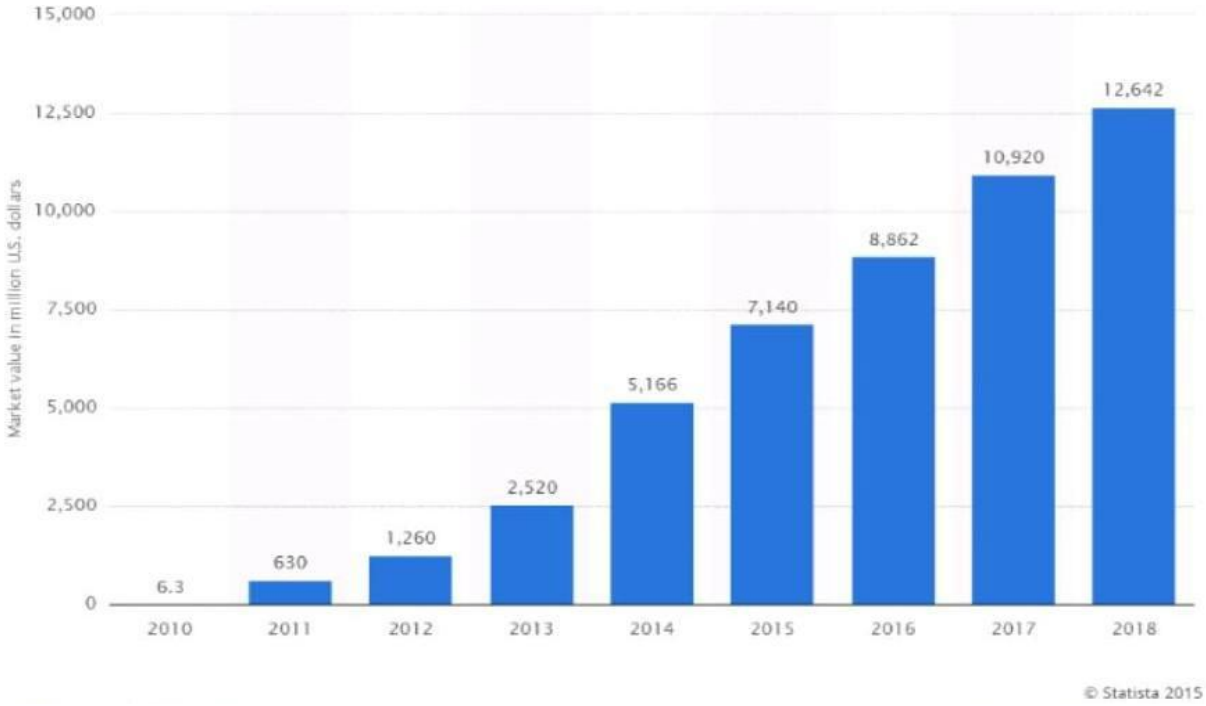
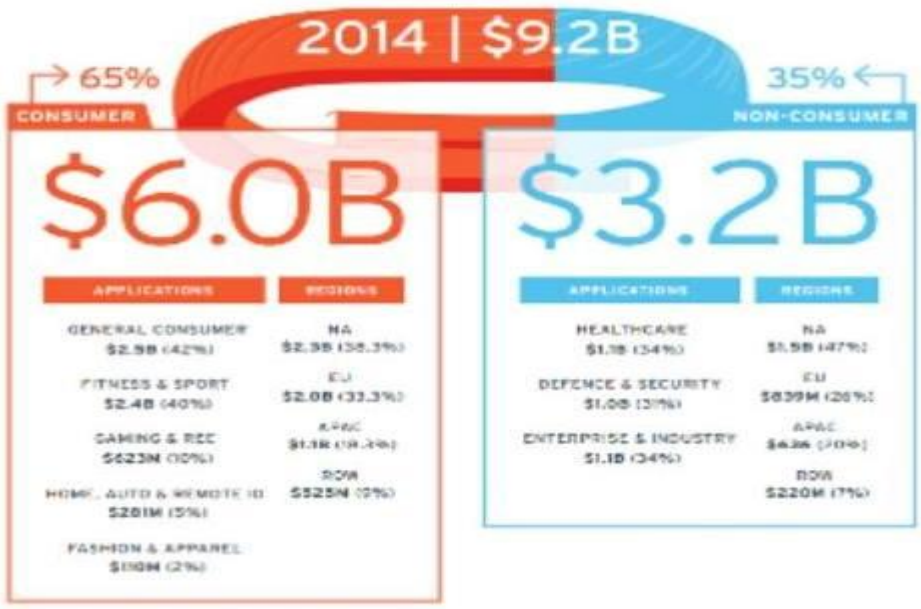


Figure 1: *Mortality from cardiovascular disease among men and women aged 45-64 years. Deaths per 100,000 inhabitants, age standardised. Interactive figure. Source: Cause of Death Registry. Diagram: Norhealth.no*

J. Expected market value of wearable devices



K. Market size for consumer and non-consumer applications by applications and region 2014-2018

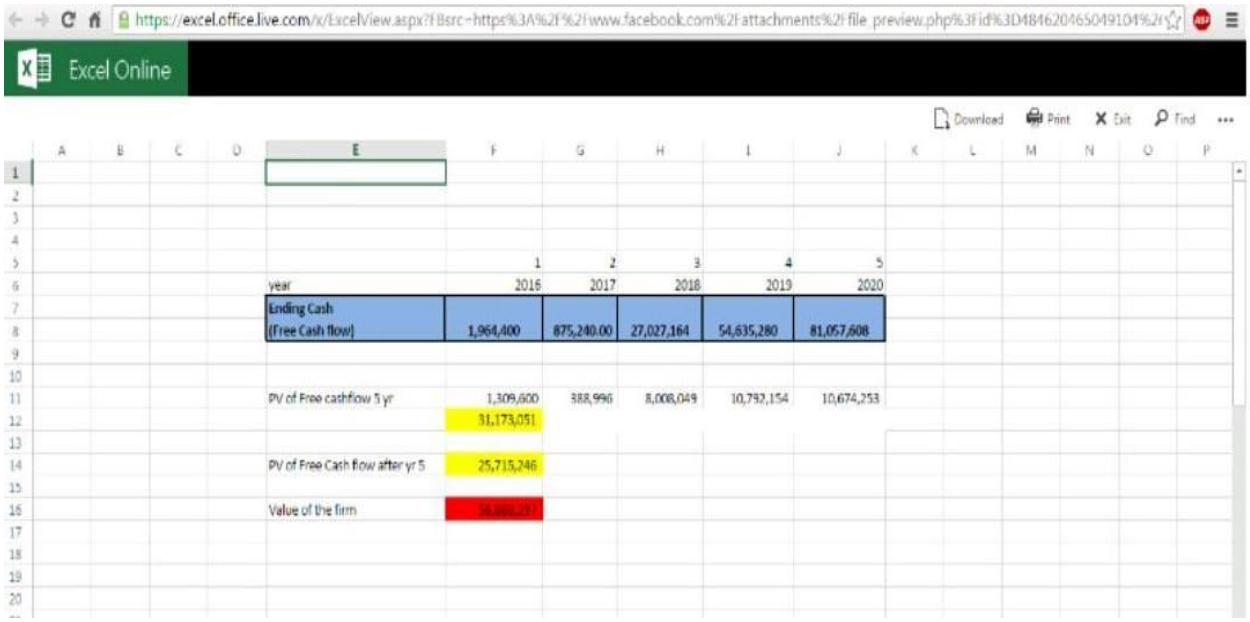


L. Market size for consumer and non-consumer applications by applications and region 2014-2018

M. Market for medical and health wearable's 2014-2018

N. Market for sports and fitness wearable's 2014-2018

O. Proposed offering calculation on Excel sheet



	1	2	3	4	5
year	2016	2017	2018	2019	2020
Ending Cash (Free Cash flow)	1,964,400	875,240.00	27,027,164	54,635,280	81,057,608
PV of Free cashflow 5 yr	1,309,600	388,996	8,008,049	10,792,154	10,674,253
	31,173,051				
PV of Free Cash flow after yr 5	25,715,246				
Value of the firm	[illegible]				

P. Pinhole's product

Q. Our Team (Pinhole As)

TORSTEN ASLAKSEN

In 1971, at the age of 6, I sat on the lap of my grandmother while she was reading to me from a book about the solar system. From that time on I wanted to become an astronomer. I got my first telescope at the age of 10 and spent most of my earnings on advanced telescope 5 years later. My passion for astronomy also matched with a talent for mathematics and physics, which earned me a PhD in theoretical physics (complex plasma) at age 29.

In the years following my PhD I worked mainly with experimental physics, building camera systems and optical sensors for rocket payloads. I became professor at the Institute of Physics and Technology, University of Tromsø, in 2003, 9 years after my PhD. I had been holding this position for 6 years, before I decided to depart from university and try my luck in the business world.

So I started Taco Scientific AS, a company that offered my knowledge and expertise in optics and hardware integration to institutions and industrial customers in the need for developing optical instrumentations that are not available “on the shelf”. During my years in Taco Scientific, I found myself equally much a student in the art of running a business than a skilled developer of various optical sensors and cameras. I also experienced that governmental businesses often are not willing to pay the real cost of services from external partners due to tight budgets. I therefore wanted to shift the focus towards the customer market and offer the results from science and improvements in technology to the general public. Additionally, I realized that in order to undertake the roles of business development, serious product developmen and proper customer follow-up, I had to expand the business.

To mark the change in business strategy and the need for more human resources, I teamed up with two other skilled mates to start a new venture, Pinhole AS. Together we aim at developing a company that transforms the advances in science and technology to products that improve the lives of others.

OLEKSANDRA

Oleksandra holds master in Business Creation and Entrepreneurship from the University of Tromsø. She started her career as a sales manager and later on as a marketing and PR manager at a small distribution company for professional hair care products. Working in a small company, with limited financial resources but limitless ambitions to promote totally new product to the national market, was fascinating and challenging task. Together with professional hairdresser she was developing unconventional promotion technique, which paid off in almost immediate increase in sales. She developed wide regional customer base in a 2-month period. Expansion of the customer base has led to 70% present increase in yearly sales comparing to previous year.

Her passion for technology was the main motivation to continue education in commercialization of technology-based innovations. One year after the education she was employed by a small spin off company, working with evaluation of alternative application areas for a technology based innovation.

VASYL BELYEY

Vasyl joined the Pinhole team as an engineering partner in 2014. He hails from Kharkiv, Ukraine. Along with his technical knowledge, he brings expertise in research activities and software development of sophisticated methods for signal processing and analysis.

Prior to joining Pinhole AS, Vasyl conducted research in the field of radio waves propagating in inhomogeneous media. He led and participated in a number of international experiments involving observations in upper atmosphere and ionosphere with the use of both coherent and incoherent scatter radars.

Vasyl studied radio physics and engineering at Kharkiv State University, where he did his graduate research at the Department of Antennas and Radio Wave Propagation on unique data collected at the world largest HF band research antenna of the UTR-2 radio telescope.

Vasyl received a Ph.D. in Physics and Mathematics from Leningrad State University. Usually, the peak of his brain activity takes place early morning.