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BUSINESS INVESTIGATION STUDY FOR THE NORDIC TELEMEDICINE CENTER USING BUSINESS MODEL CANVAS AND MONTE CARLO SIMULATION

Master's thesis for the degree of Master of Science in Technology submitted for inspection, Vaasa, 18 May 2018.

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ABSTRACT: The eHealth industry has caught huge attention during the last decade especially in Nordic countries. The concept of telemedicine is becoming an essential factor in the healthcare sector owing to its advantageous edges that made remote diagnosis and monitoring become more viable. Such role that brought numerous patients' cases within the reach of healthcare professionals, facilitated the continuous monitoring of their vital signs and kept records of their previous health history for better treatments. However, telemedicine projects –as any other type of projects– should possess a preliminary feasibility plan described in business terms to speculate the likelihood of failure or success based on the resources and the value proposition. Various worldwide approaches have been conducted in many countries to provide the suitable business frames for the telemedicine business model. One of the main objectives of the Nordic telemedicine Center (NTC) project is to establish a running center that operates and sustains itself even after the project period is concluded thus, a feasible business model is required. In this thesis, an approach is designed upon the business model Canvas structure. The proposed canvas is based on the Nordic telemedicine Center project's resources and objectives. Nevertheless, the output canvas is assigned with a conducted Monte Carlo simulation to obtain some business insights relying on both real and assumed input data.

1. INTRODUCTION

As stated by (Peters, Kromat and Leimeister 2015): "Service has grown into an important field for research in information systems, as information technology (IT) is currently revolutionizing the way services are delivered. Many services hereby not only play a key role for societal advancements but become necessary". This statement summarizes recent technologies' scope and where are they heading. The clear destination is bounded by the basic "Information Theory" as it already was since the earliest stages of humanity.

Telemedicine not only considered a welfare aspect but also became a necessity in many cases. With the aid of IT evolution, telemedicine became applicable in remote places and difficult conditions. Moreover, regarding that point, (Wang, Lin and Chiang 2014) stated that: "With the advancement in information and telecommunication technologies, Telehomecare can surmount obstacles in space and time and exchange clinical information between patients and experts, which fulfill the patients' needs of the aged society".

However, according to (Kao, et al., 2012): "Continued advances in science and technology and general improvements in environmental and social conditions have increased life expectancy around the world. As a result, the world's population is aging". Statistics show that, in certain regions in the Nordic countries there are approximately 25% of the population are exceeding 65 years old. This large percentage sheds more responsibility on governments to prepare suitable precautions and arrangements for providing maximum care to this age group. (Statistics Finland 2017)

Consequently, telemedicine implementation evolves from a 'concept' to be a completely stand-alone 'business' in itself that requires business planning and market research. Provided that "Successful business models in the field of complex services are rare and often not profitable so far" as stated by (Peters, Kromat and Leimeister 2015), business models for telemedicine applications worldwide had started to show up during the last decade.

The main topic of this Master's Thesis work is investigating business opportunities for the Nordic telemedicine Center (NTC) project in the Ostrobothnia region. The project is funded by the Interreg Bothnia Atlantica, which is one of the European Union funding mechanisms. The main aim of NTC project is to establish physical and virtual telemedicine center units (nodes) in Nordic countries to form Nordic telemedicine Network. Currently the project is ongoing in Finland and Sweden. Operations are targeted to be extended to other Nordic countries. The rest of the thesis chapters are organized as follows:

Chapter 2 highlights the evolution of eHealth and telemedicine especially in Nordic countries. Most often people do not know the difference between eHealth and telemedicine hence this chapter provides detailed explanations for both aspects.

Chapter 3 states the pillars of the successful business model design. The chapter provides more insights about business planning, framework and actions from different perspectives. The author discusses about some well-known business models within the chapter and choose the suitable one to work on for the NTC project.

Chapter 4 displays the building blocks of the NTC Business Model Canvas based on what was described in Chapter 3. It contains the main exerted efforts for the investigation study to fill in the required blocks of the case study beforehand, NTC as a case study. The chapter also includes extra recommendations founded by the author besides the existed facts in the ongoing project. Finally, a SWOT analysis is rendered to summarize all the strengths and weaknesses of the business model internally and externally.

In Chapter 5, Monte Carlo statistical method is used to evaluate the system performance based on some collected real and assumed statistics to provide some insights about the project. Simulations are carried out using MATLAB software.

Chapter 6 concludes all the study results achieved from this investigation, gives some ideas and forecast for the future work to improve the NTC business model.

2. EHEALTH AND TELEMEDICINE

2.1 eHealth

2.1.1 Definition and Concept

eHealth is a widely used technological term since the earliest 2000s that was originally the abbreviation of electronic healthcare. It refers to the use of emerging information and communications technology to improve health or enable healthcare. (Neter & Brainin 2012)

eHealth is the broader umbrella term that includes Telehealth, mHealth, telemedicine and Tele-homecare as shown in Figure 1. Examples of eHealth are e-prescribing, electronic health records (EHR) and the transfer of patient data between different care centers. (Jørgensen and Hallenborg 2015)
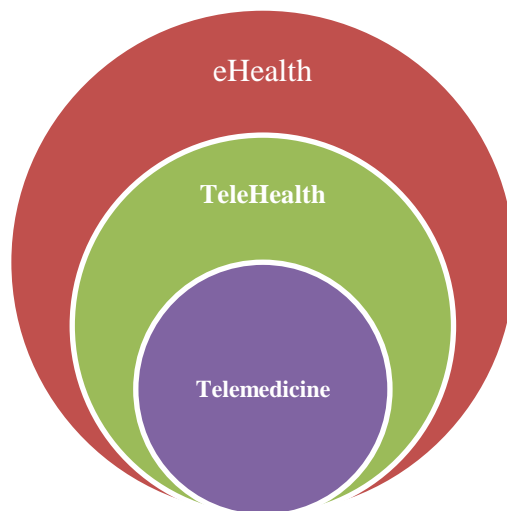
Figure 1. Relation between eHealth and telemedicine.

2.1.2 eHealth Evolution

It is argued that eHealth concept emerged because of the Internet's evolution from Web 1.0, which was referred to as the static source of information to the interactive Internet medium named as Web 2.0 back in 2000. Some of the unique applications of Web 2.0 are for example: forums, wikis, blogs, virtual communities and social networks. (Limburg & Gemert-Pijnen 2010)

Another argument perspective states that eHealth evolved thanks to three revolutions that have occurred since mid-twentieth century. Changes in conceptions of time and space along with the organizational changes caused by Information Technology revolution eventually produced eHealth as one of their consequences. Consequently, the beneficiary consumer (patient) looked for more access to his records, information, products and secured services anywhere, anytime. Thus, healthcare providers, individual physicians, Hospitals and insurance companies had been such subjects to the previous consumer demands besides responding to the challenge of the empowered consumer. (Helman, Addeo, Santoso, Walters, & Helman 2015)

The three revolutions' perspective offers help to elaborate how these big changes originally occurred hence researchers can assume what will be the pattern of future changes that may reshape healthcare on the long run and predict the business models that can fit to such changes. (Helman, Addeo, Santoso, Walters, & Helman 2015)

There is no doubt that the most significant change produced through the three revolutions was the advent of the Internet. As a result, many consumers occupy a variety of adapted landscapes as shown in Figure 2.
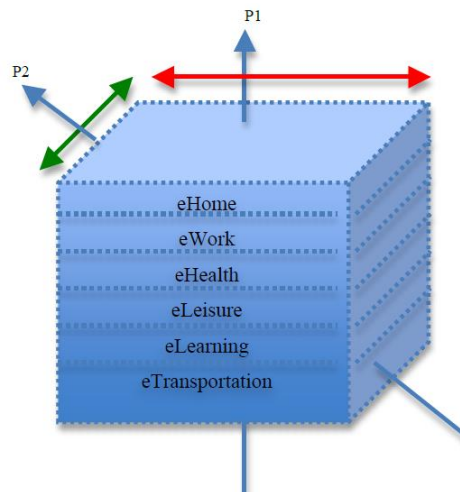
Figure 2. Dimensions of business response of consumer value proposition (Red) and the dimensions of consumer's desired benefits (Green). (Helman, Addeo, Santoso, Walters, & Helman 2015)

The pathway of consumer P1 displays that the consumer (patient) is fully integrated into the network and knowledgeable about devices which implies that he or she may have chronic disease e.g. diabetes but still can connect through the eHealth network, get the

required information. Adjust diet and get prescriptions. While on the other hand, consumer P2 pathway indicates that he or she is not well connected which means less integrated to the network thus other means of communication are to be sought and may experience higher costs in acquiring the demands of his medical condition. (Helman, Addeo, Santoso, Walters, & Helman 2015)

2.1.3   eHealth Advantages

Accordingly, eHealth provided three major benefits to modern healthcare, as follows:

a)   Better information

Patients and healthcare professionals can share information between each other easily and continuously to improve diagnosis and treatments. Through Internet, information can be transferred instantly to reach the beneficiary personnel at the appropriate time. Moreover, healthcare professionals can cooperate on global scale thanks to the real-time information being processed. With regular health tips, newsfeed and information provision to patients, they can get more aware about their conditions, symptoms, treatment and curing. Thus, new patients can benefits from other patients' experience with same problems. (Limburg & Gemert-Pijnen 2010)

b)   Effective care

In eHealth, healthcare professionals are to carry out the treatment process using a chain of activities, which are often referred to as Disease Management. The efficiency and the improvement of the process depend on the alignment of the activity chains. With the help of eHealth applications, activities' alignment can be performed, and redundant activities can be eliminated. Besides, patients can get more involved in their treatment processes as they can be triggered to participate in the treatment, monitor and administer medications. Thus, improving the well-being of the patient arises as an extra benefit from this point. (Limburg & Gemert-Pijnen 2010)

c)   Focus on patient

With the flow of information to patients via Internet and communications with peers about the treatment possibilities, patient empowerment is resulted. It means that a more demand-driven type of healthcare with the patient as the focus. Patients will be more

capable of managing their treatment on their own in addition to obtain tailored care based on their status and personal needs. (Limburg & Gemert-Pijnen 2010)

2.2 Telehealth

2.2.1 Definition and Concept

Telehealth is a subset of the broader eHealth systems, which displays the healthcare services' delivery for longer distances and remote places. Telehealth includes the services, systems and technologies that are required to enable patients to stay at home instead of coming to Hospitals. Exchange of photos, remote monitoring and wiring physiological measurements are examples of the Telehealth services. (Jørgensen and Hallenborg 2015)

A study in 2015 assumes that Telehealth solutions are expected to grow approximately by 20% annually within the years after. Main advantages of Telehealth are the potential to reduce the number and duration of Hospital visits, evolve as an important element in the integrated care model and strengthen the patient empowerment. The Integrated Care Model is defined as the coordination of doers such as general practitioners, Hospitals and municipalities who are providing health services for the beneficiaries such as patients to secure more coherent pathways for the patients. Data sharing between the doers via Telehealth systems is one important element to obtain an integrated care model. Moreover, patient empowerment purpose is to encourage the patient to take more active responsibility of his own healthcare by participating in crucial decisions and carry out some of the physical measurements of his body. (Jørgensen and Hallenborg 2015)

Telehealth bestows benefits for all participants in the process; patients, healthcare professionals, healthcare organizations, and public authorities. Regardless, there exist some challenges that oppose large-scale deployments and adoption of telehealth such as the absence of national infrastructures to facilitate the collection health data from patients' homes as well as data exchange facilities between homecare systems and the professional health records. (Jørgensen and Hallenborg 2015)

2.2.2   Telehealth in Nordic Countries

Nordic countries, which are Finland, Sweden, Norway, Denmark and Iceland, are considered the international frontrunners in employing information technology into healthcare care sectors. Through recent decades, Nordic countries have collaborated to share research on the subject, for example, they established the Nordic eHealth and telemedicine conferences through the Nordic Council of Ministers. (Jørgensen and Hallenborg 2015)

Interoperability is a one important driver for healthcare systems for promoting more adapted health services, which in turns accelerates the discovery of new knowledge. The European Commission paid great attention towards the importance of interoperability in eHealth since the beginning of the new millennium as stated in Europe 2020 strategy. (Jørgensen and Hallenborg 2015)

Each of the member states of the European Commission committed themselves to collaborate on report series to achieve the previous focus point, which are published back in 2010. Table 1 displays the national authority for each corresponding Nordic country.

Country	National authority/authorities
Denmark	• The National eHealth Authority • MedCom
Finland	• Ministry of Social Affairs and Health • The National Institute for Health and Welfare
Iceland	• Ministry of Welfare • The Directorate of Health
Norway	• The Norwegian Directorate of Health
Sweden	• The Swedish eHealth Agency • Inera

Table 1. National healthcare authorities in Nordic countries. (Jørgensen and Hallenborg 2015)

- Denmark

The National eHealth Authority in Denmark published the document "Reference Architecture for Collecting Health Data from Citizens" in 2013 as a resultant of five workshops carried out in collaboration between MedCom, DELTA and the Local Government of Denmark. That reference architecture was set as an outcome of the action plan stated in 2012. The plan recommended that reference architecture was needed to deploy Telehealth solutions on large scale as a factor of the future digital welfare reform in the country. Denmark was the first worldwide country to set the base for their national Telehealth infrastructure on the Continua Health Alliance Framework (CHAF), which is a personal connected health alliance that aims to develop health and wellness as an effortless part of daily life. (Jørgensen and Hallenborg 2015)

- Finland

During the 2000s, there are four conducted surveys on the status and trends in Finnish eHealth during the years 2003, 2005, 2007 and 2011. The last conducted survey was the basis of the published report in 2013 titled "eHealth and eWelfare of Finland – Checkpoint 2011". The Finnish focus was the development of the National Archive of Health Information (KanTa). Some Telehealth pilots were carried out as well. Starting from 2014, the Finnish authorities obligated public healthcare providers to join KanTa and in 2015, the obligation extended to include private healthcare providers as well. Because the healthcare providers' health record systems are the main data sources for KanTa, they must follow common guidelines to describe variety of data elements such as patient identity, clinical records and health risk data. (Jørgensen and Hallenborg 2015)

- Iceland

Iceland is one of the leading countries in information technology infrastructures worldwide whereas it aims to become a pioneer in delivering online and electronic public services including healthcare. The Icelandic healthcare sector is a network called Heilsunet (Health net) which is responsible for achieving the country's vision in healthcare since 2007. The mission of Heilsunet is to facilitate secure data connections and link all healthcare institutions in the country. Telehealth application started to appear in Iceland back during the 1990s such as tele-psychiatry and tele-radiology. (Jørgensen and Hallenborg 2015)

- Norway

Telehealth started to gain interest in Norway since 1998. A report published by the Norwegian governmental website "Sosial- og helsedepartementet" described the requirements and the roadway for applying telemedicine throughout Norway in the same year. (Blomberg, Myklebust, Engum & Nakken 1999)

Since 2014, the Norwegian Directorate of Health's publication titled "Anbefaling på valg av standarder/rammeverk for velferdsteknologi" set the wide outlines for the standards and framework to be considered in Telehealth in the future besides setting a model for national reference architecture for the domain. Later in the same year, the Directorate published a document to describe the structure of the future Norwegian reference architecture in more details, called "Helsedirektoratets anbefalinger på det velferdsteknologiske området". The reference architecture version shown in Figure 3 is based on the Continua Framework. (Jørgensen and Hallenborg 2015)
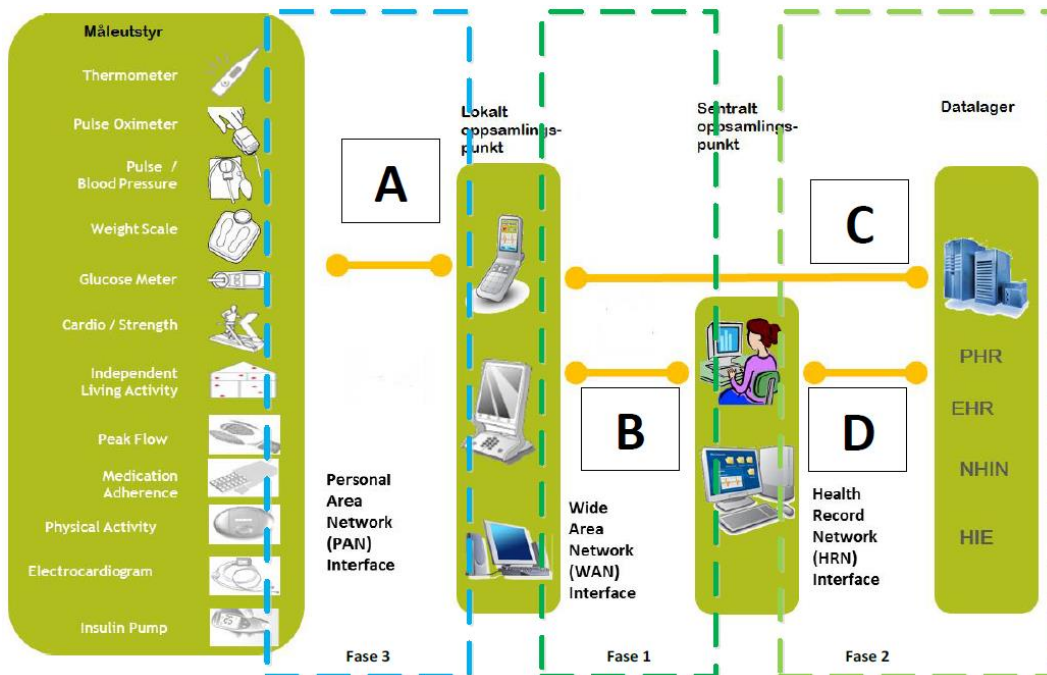
Figure 3. The Norwegian Telehealth reference architecture. (Jørgensen and Hallenborg 2015)

- Sweden

The Swedish Ministry of Health and Social Affairs outlined the Swedish strategy of using information technology within the healthcare sector via the publication titled "National eHealth – the strategy for accessible and secure information in health and social care" in 2010. The Swedish focus was on applying eHealth as a broad term from an ICT infrastructure perspective, same as the Norwegian and the Danish ones though Sweden possess a wide range of Telehealth applications such as remote patient monitoring and teleconsultation between the patient and the medical staff. The main target for Sweden in eHealth on the long run is to deliver healthcare to the residential homes. (Jørgensen and Hallenborg 2015)

2.3 Telemedicine

2.3.1 Definition and Concept

Telemedicine is a subset from Telehealth. According to European Commission's Advanced Informatics Programme in Medicine, telemedicine is defined as the "Rapid access to shared and remote medical expertise by means of telecommunications and information technologies, no matter where the patient or relevant information is located". Telemedicine does not introduce anything new to the medical sector; instead, it is a set of communication means and services that allow the medical resources to be used in modern and efficient ways. (Blomberg, Myklebust, Engum & Nakken 1999)

2.3.2 International Adoption

From an international perspective, Telemedical services have grown exponentially during the 2000s. Developed countries projected large-sized expenditures towards telemedicine research. Countries that possess the most progress in telemedicine are The United States, Canada, Australia, Nordic countries and Western European nations. Telemedicine has the capability to cross geographical and political boundaries via numerous communication means including the Internet. Thus, a worldwide Telemedical network is achievable by the integration between different national telemedicine systems. (Blomberg, Myklebust, Engum & Nakken 1999)

2.3.3 Telemedicine in Nordic Countries

The first Nordic telemedicine joint project was among the years 1993 – 1995. It was a tele-radiology project that included the cities of Oulu (Finland), Reykjavik (Iceland) and Tromsø (Norway). The Swedish Planning and Rationalization Institute of the Health Services (SPRI) held a tele-radiology conference in the earliest of 1990s. Finland hosted the first Nordic telemedicine conference in 1996. The Nordic telemedicine Association was founded during autumn 1999 in Greenland as a federation of the national telemedicine associations and organizations. Later in 2012, the Nordic eHealth Group which was founded by the Nordic Council of Ministers introduced the Nordic eHealth Research Network (NeRN) as a team focusing on health information exchange and patient portal functionalities. (Kouri 2015)

The Nordic national eHealth strategies are typically based on standards, public funding and centralized governance. Among the key targets are improved information security, guaranteed privacy of the patient records and increased patient influence. New ICT infrastructures are also utilized by the healthcare organizations to provide better access for the users. (Kouri 2015)

3. BUSINESS MODEL DESIGN

A business model is a proactive study that describes the way of how an organization create and deliver a value with a main goal of capturing the expected revenue. It is like a blueprint for the organizational ongoing strategy to be carried out via its structures, systems and processes. (Osterwalder and Pigneur 2010)

Understanding the concept and the idea behind the business model allows every member of the organization to work on facilitation of each role described in the model to achieve the set goal. That is achievable by holding constructive conversations among the organizational meetings to spread the organization's business model milestones among the team and gain the most focus on the desired goal. The concept should be simple, to-the-point and understandable on all levels. (Osterwalder and Pigneur 2010)

3.1. Types of Business Models

Business modelling can be exhibited using many classifications, for businesses already started in ancient eras and its sorts of modelling varied through the ages until nowadays. It can be classified according to the market needs, own resources, partnerships and customer types. The main method for generating the type of business model that the organization should follow comes after answering these questions:

- What does the organization sell?
- To whom?
- Why?
- When?
- And how?

The value or product or service that is presented by the organization is defined by the first question: "What are you selling?" The targeted audience or customers are described after answering the second question: "To whom?". The third question portraits the reason behind delivering such a value and no other hence desired outcome from the whole business could be verified. The fourth and the fifth questions are the key to establish the appropriate channel between the business and the customer by knowing how and when to deliver such value, resulting in solid customer relationship.

3.2. Role of Business Model in Telemedicine

There is a great need for a well-planned national move towards adapting telemedicine technologies to help patients with chronic diseases hence effectively take control of their chronic conditions that leads to a relief in the governmental mission of the National Health System (NHS). The expression people with chronic diseases does not only refer to the people who are carriers of chronically dangerous disease as AIDS or Viruses, elder people are sometimes clinically referred to as people with chronic disease as well. The main challenge of telemedicine industry for Healthcare companies and eHealth investors is the uncertainty of cost Vs revenue) equation that is always associated with telemedicine. Such organizations are expecting fine national approach towards the field along with demonstration of cost efficiency to fade such ambiguity. Reducing National Healthcare burden is viable through reducing frequent people visits to healthcare providers, limiting unnecessary visits to physicians, monitoring vital signals all the time on 24/7 basis hence providing chronic disease prevention as well as treatment in case of infection. (Prag & Yeghiazarian 2006)

In simple words, the telemedicine business model is the determination of the type of services or value offering that should be carried out by healthcare organization and how such value should be presented in order to stream revenues within the healthcare market. The business could be referred to as ROI (Return on Investment) or the cost-efficiency equation that is solved by the healthcare organization to monetize its value. Each organization should spend appropriate time budget in analyzing patients' needs, chronic disease management technologies and remote patient monitoring solutions to benefit from each pillar of the business model for decision takers hence financial success. Obviously, the main goal of such analysis is to define what should be the offered value that triggers all other parts of the model to maintain cost efficiency. (Prag & Yeghiazarian 2006)

Healthcare professionals use business models to state the degree of suitability and reality of telemedicine technologies systems that are used for chronic care management on the

long term and whether such technologies have ROI and cost reduction or not. (Prag & Yeghiazarian 2006)

The national approach should fulfill four healthcare organization demands for enhancing the telemedicine business model:

- **Strategy**: Obtaining the strategic value of chronic disease telemedicine systems. Locating and collecting meaningful data for measuring an organization's progress with respect to achieving its strategic aim as one of the challenges that face healthcare systems. This strategic value is not yet defined for telemedicine systems in the United Kingdom; it requires more effort to be sorted out. (Prag & Yeghiazarian 2006)

- **People**: Healthcare organization success relies on how the healthcare professionals are recognized or valued because it has been found that switch of unit members identities from the job description to their achievements returned improvement of efficiency and morale thus resulted in cost savings. (Prag & Yeghiazarian 2006)

- **Process**: Applying telemedicine business model including remote monitoring systems deployment proves the cost reduction, productivity and the expected added efficiency for the healthcare organization. The business model should include all characteristics of the healthcare framework using a quantized relation for the internal and external healthcare organization processes, from the organizational management perspective (top-to-bottom view) of policies and processes, and from healthcare professionals-patient perspective (bottom-to-top view) to ensure efficient processes and reducing future costs through the IT layer by inbounding and outsourcing new services. (Prag & Yeghiazarian 2006)

- **Technology**: The main purpose of telemedicine is to serve best medical diagnosis and healthcare to the remote patients via all available means of technology. Such technologies can be mobile telecommunication and wireless telemedicine. Technology is a crucial player in the telemedicine system deployment and for all personnel who are involved. The determination of systems' return on investment (ROI) usually takes at least 18 months to obtain, while considering medical

applications, services, products, training and development. (Prag & Yeghiazarian 2006)

The previous four requirements for healthcare organization can be integrated to form a measurable evaluation for the telemedicine system, as shown in Figure 4.
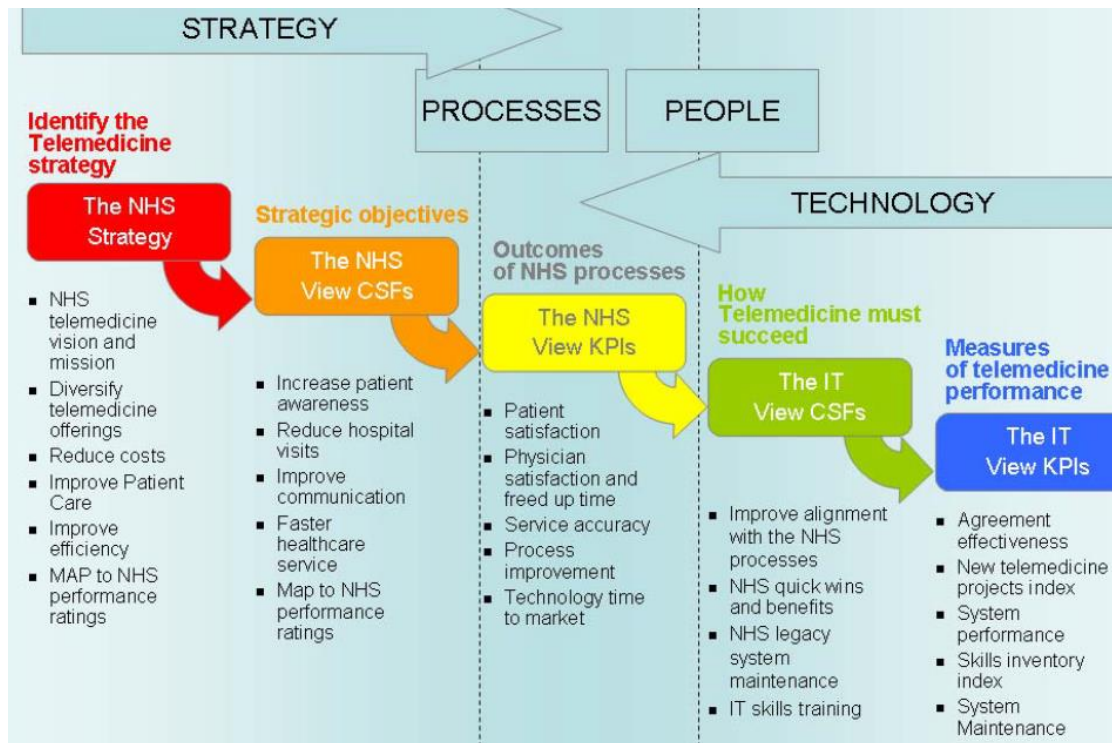
Figure 4. Integrating the four healthcare organization requirements. (Prag & Yeghiazarian 2006)

The main objective of integrating the four healthcare organization requirements is to formulate the value of the telemedicine system. This can be obtained through the specialized telemedicine business model to measure the impact of healthcare management systems concerning chronic disease holders.

It is good to notice that the NHS is not equivalent to the NTC project. The NHS is actually the equivalent to the whole Finnish healthcare sector. The mentioned framework is the NHS framework for telemedicine and the healthcare organization requirements only.

3.3.   Business Model Framework

To fulfill the objective of defining the value, the business model should contain the key relevant factors for sustainability. The majority of telemedicine projects in the United Kingdom are carried out from a clinical trial perspective with no analysis for the future and ongoing costs. One efficient way to carry out a sustainable development of telemedicine is to establish a collaborative environment within the healthcare organization whereas clinical trials should be monitored as cost center business projects concentrating on the ROI (return on investment) and cost reduction. (Prag & Yeghiazarian 2006)

Cost center business projects require the following business drivers:
- The proof of cost-benefit analysis and cost-efficiency of the telemedicine project
- SWOT analysis to define strengths and weaknesses of the healthcare organization internally besides the opportunities and threats externally.
- Measure the effect of telemedicine system to clinical trials by comparing a current clinical trial without telemedicine system and other clinical trial with a telemedicine system.
- Defining organization needs and personnel demands (like patients and physicians) from the remote chronic disease monitoring system.

Supporting the previous business drivers can be through:
- Financial assessment by setting Key Performance Indicators (KPIs) and Critical Success Factors (CFS).
- Determination of business volume needed for break-even in terms of telemedicine system profit and loss.
- Predication of type of activity required for gaining the targeted profitability and ROI within time budget.

Whenever business drivers such as CSFs and KPIs are defined then they should be integrated in the whole telemedicine business model for chronic care management to weigh the effect of telemedicine, as shown in Figure 5.
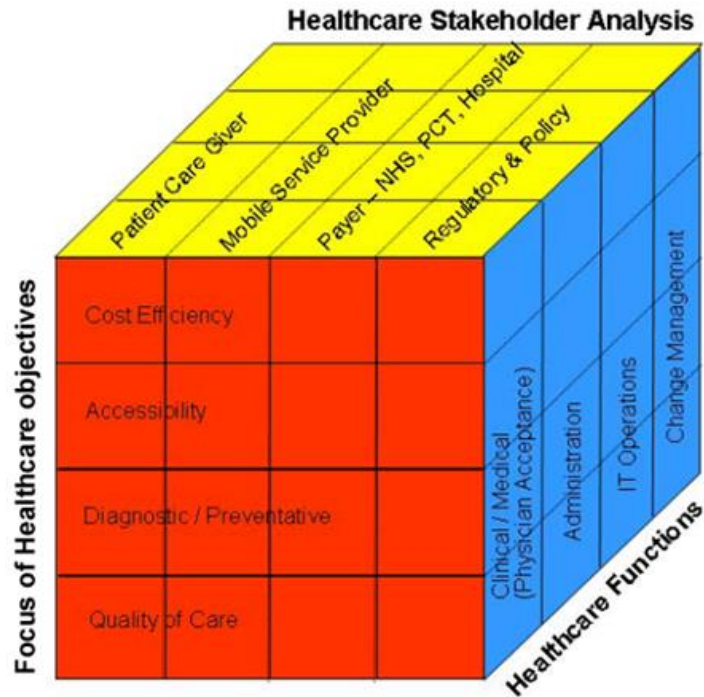
Figure 5. The proposed business model for chronic care management using three focus areas: A) Healthcare Objectives, B) Stakeholder Analysis and C) Healthcare Functions. (Prag & Yeghiazarian 2006)

The previous proposed cube-like model encapsulates the characteristics of the telemedicine business model that fit healthcare organizations in the United Kingdom. This 3D cube in Figure 5 shows the linked building blocks required by healthcare organizations for a complete business assessment as a cause for implementing management system for telemedicine chronic disease healthcare. The focuses are healthcare objectives, healthcare stakeholder analysis and healthcare functions. Table 2 presents the three focus areas and the telemedicine business model's building blocks, from which each of them consists of. One advantage of this structure is that every building block can be evaluated separately and thoroughly to meet the set KPIs and provide the expected value of the telemedicine management system for healthcare organization. (Prag & Yeghiazarian 2006)

Focus area	Role	Building blocks

Healthcare Objectives	Identify the Healthcare objectives when performing an assessment for emerging technology for diabetes care.	• Cost Efficiency
		   o Identifying tangible and intangible costs that constrain chronic care
		• Accessibility
		   o Access to improved healthcare
		• Diagnostic/Prevention
		   o Mechanisms to improve chronic care and make timely preventative measures
		• Quality of care

Stakeholder Analysis	Identify the stakeholders who will be directly or indirectly affected by the launch of a telemedicine service.	• Patient care provider
		   o Surveying care provider's views
		• mobile provider
		   o Obtain industry emerging technology trends and technology roadmaps
		• Payer (Primary care, Hospital)
		   o Ensuring payer of service is willing to subsidize payment for m-health service quality of care
		• Regulator
		   o Evaluating the m-health model of service for delivery and healthcare policy decision making

Healthcare Functions	Identify the healthcare functional areas that will be impacted by a telemedicine decision and ongoing service management	• Clinical/Medical
		   o Continuity of informed and efficient care to patients
		• Administration
		   o Ensuring continuity of care is within reach and available to patients
		• IT Operations
		   o Make sure certain Healthcare operations frameworks are in place for chronic care and management
		• Change management
		   o Transforming the Healthcare Organization to ensure the success of chronic disease management

Table 2. Building blocks of each focus area of the telemedicine business model. (Prag & Yeghiazarian 2006)

3.4. Popular Business Models

Business models can be classified according to the type of business, shown in Figure 6.
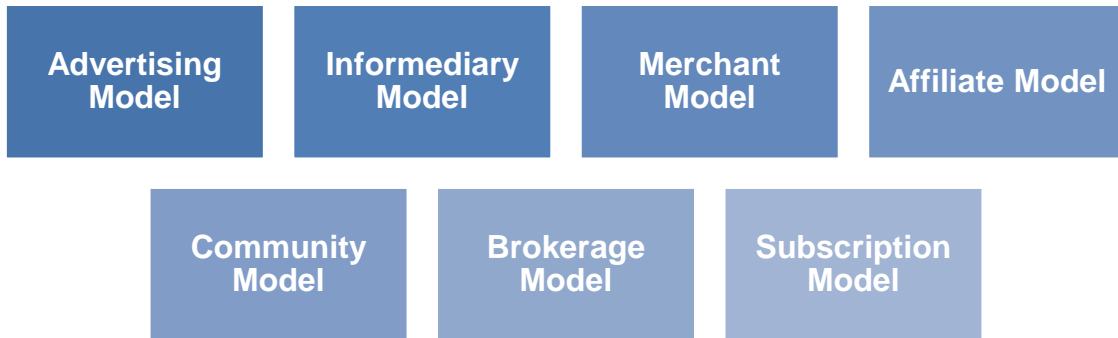
Figure 6. Types of business models according to the type of business. (Slidehunter 2017)

3.4.1. Brokerage Model

Whereas the broker offers his service for brokering other users account against an agreed charge for that service based on the broker's own experience. In other words, the business sells its experience in brokerage as a value. This type of business can be entitled as a market maker business, whereas brokers succeed in gathering sellers and buyers together for performing business transactions. (Slidehunter 2017)

3.4.2. Advertising Model

Advertising business model is the traditional way of media broadcasting marketing model whereas an advertising company offers its media channels as a service for promoting other businesses services and products. Therefore, the value here is the experience of market dissection and own media channels as an asset. (Slidehunter 2017)

3.4.3. Infomediary Model

Infomediary business model offers information concerning understanding the market for their business partners; it is more likely to be consulting rather than selling a certain product or service. These infomediaries help assist buyers and sellers to acquire clearer view of the current market. (Slidehunter 2017)

3.4.4. Merchant Model

In Merchant Model, the firm provides service and offers goods through direct sales whereas the merchant is the one who is responsible for the product. Revenue is gained through selling goods according to price listing or auctions. (Slidehunter 2017)

3.4.5. Affiliate Model

In Affiliate Model, companies offer incentives to their affiliate partners upon helping them to redirecting customers to their marketplace or online e-shop portal. This model gained huge popularity especially in online digital marketing platforms and e-commerce. (Slidehunter 2017)

3.4.6. Community Model

Community business model is mainly based on user's affections toward the business i.e. loyalty to certain brand. The revenue here depends on the type of product. (Slidehunter 2017)

3.4.7. Subscription Model

Subscription business model facilitates customer communication and interaction by charging customers periodically such as daily or monthly basis for the continuation of service provision. (Slidehunter 2017)

3.5. Business Idea

The idea is the most important aspect in which the business plan is formed around. It is the building cornerstone of any business plan to be launched whereas it displays the desired value to be presented, to whom it will be presented and how to implement it. Although the good idea and the entrepreneur's motivation are essential, that does not guarantee a successful business. The execution of a business plan requires personal skills, qualities and financial funds. In addition, competitor analysis should be carried out to obtain the competitive edges and leveraging additions. (Tran 2014)

3.6. Business Plan

A business plan is the entrepreneurs' roadmap resulted from intense research to startup their business. The plan should include the description of the business idea, the executive summary, the marketing strategy and the financial plan stating the expected costs and profit. (Tran 2014)

In addition to be the showcase of the owner's intention for the business, it can be used in negotiations with prospective funders, partners and suppliers. The writing style of the business plan differs depending on the type of audience or the intended reader. For instance, the business plan intended for investors would focus more on the overall profit at lower risks. (Tran 2014)

3.6.1. Elements of a Business Plan

The business plan does not have an exact shape because it is case-dependent and varies according to the internal and external factors. Nevertheless, there are certain aspects that should be presented in any business plan, which are shown in Figure 7.

- Business background

The description of the business background is the main drive for motivation towards the business. It encapsulates the business vision, required mission, business objectives and legalities.

- Executive summary

Executive Summary is a short-length summarization of the business plan highlighting the business idea, the products or services, target group and financial Figures. The main goal is to introduce the business briefly in order to highlight the idea for prospective investors or funders. This step should be formalized after finishing all other parts. (Tran 2014)

- Market research

Market research is a thorough study, which contains several aspects about the market as the target market, expected market-share, intended customers, channels and competitors. The effective market analysis can significantly push the business forward. Two types of market researches can be conducted: primary research and

secondary research. Primary research is gathering own data via surveys and interviews whereas secondary research is acquiring market information via the media whether it is published, broadcasted or graphic. Finally, information about the competitive advantage can be rendered. (Tran 2014)

- Marketing strategy

Marketing strategy can be viewed as the plan on how to get to the business objectives. It starts with SWOT analysis: which is identifying the strengths, weaknesses, opportunities and threats. The marketing strategy consists of three steps: analysis, formulation and implementation. The strategic analysis identifies the SWOT factors through a deep understanding whereas the strategic formulation identifies the strategic options to evaluate and later select the suitable strategy. Finally, the strategic implementation is the execution of the defined strategy. (Tran 2014)

- Operational plan

The operational plan encapsulates the daily routine of the business in addition to the status of the equipment, human resources and other surrounding elements. Furthermore, it should also include information about legal requirements, personnel management, inventory, suppliers and distribution. (Tran 2014)

- Financial plan

The financial plan states the expected profit versus costs, cash-flow projection, a projected balance sheet and break-even calculation. (Tran 2014)

Figure 7. The elements of a business plan. (Tran 2014)

3.7.   The Osterwalder Business Model Canvas

The Business Model Canvas is a global method introduced by Alexander Osterwalder, a Swiss business theorist, author and consultant. This model is used by wide variety of companies worldwide of all sizes of businesses. The canvas can be used to design, describe and generate the business model and the expected shape of value proposition to be served to the audience. (Osterwalder and Pigneur 2010)

This Osterwalder model is proven to be modern, appropriate and condensed business model that fits to the target of numerous business ideas. It is a business research plan and an action plan at the same time for it states the business resources and activities both alike. (Osterwalder and Pigneur 2010)

The Osterwalder canvas consists of nine main building blocks:

1- Customer segments

2- Value proposition

3- channels

4- Customer relationships

5- Revenue streams

6- Key resources

7- Key activities

8- Key partnerships

9- Cost structure

Figure 8 illustrates the Business Model Canvas.
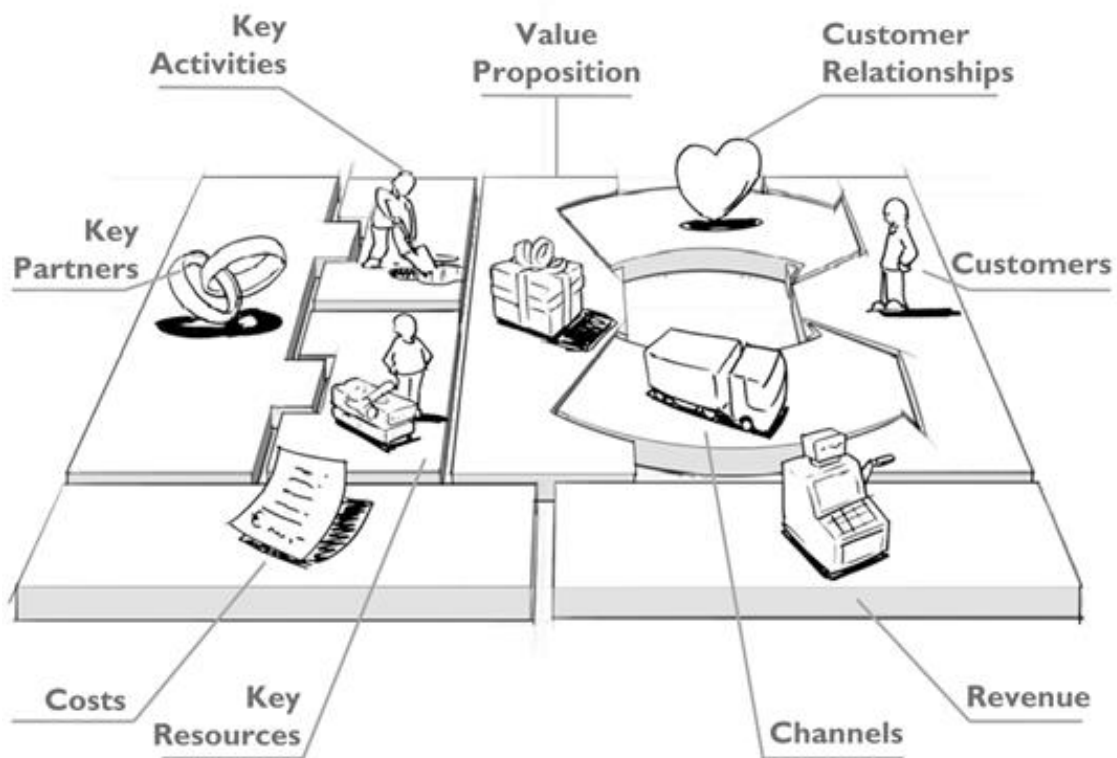
Figure 8. Business model Canvas by Alexander Osterwalder. (Osterwalder and Pigneur 2010)

3.7.1. Customer Segments

The customer segment building block defines the various groups of people or organizations which the business seeks to reach and serve. Customers are the center point of any business model, without potential customers the business revenue is certainly will be attenuating to an end. (Osterwalder and Pigneur 2010)
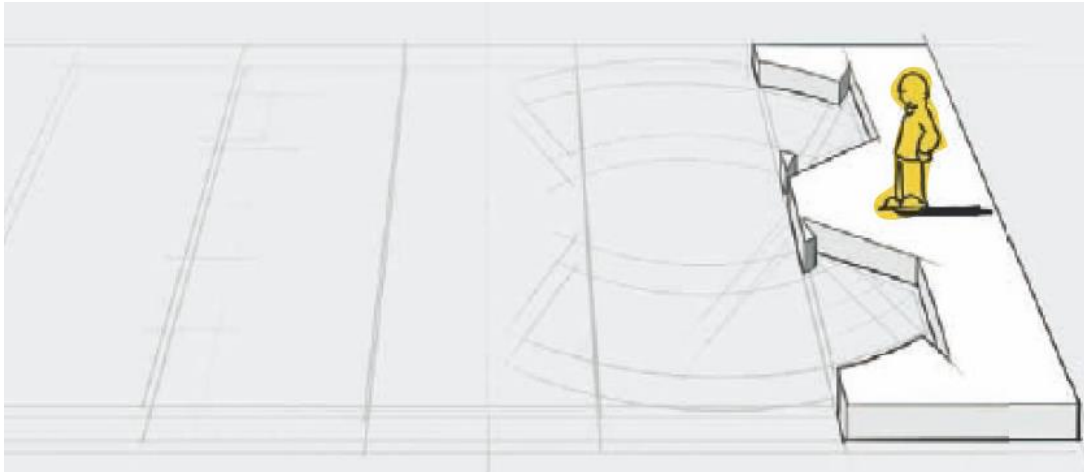
Figure 9. Customer segment building block. (Osterwalder and Pigneur 2010)

Companies usually tend to form segmentation for their customers by grouping them according to their common needs, common behaviors and other attributes. The business model can state several-sized customer segments, the company or the organization should decide which segment to focus on and which should be discarded. Customer groups represent distinct segments when their needs require unique offers. Reaching out to customers is carried out via different channels. Hence, customers require various types of relationships because they provide different profitability to the business and are ready to pay for different forms of offers. After identifying the targeted customer segments, the business model can then be designed around a solid understanding of customer needs. (Osterwalder and Pigneur 2010)

Customer segments can be classified to the following categories:

- Mass market

Business models that are focusing on mass markets do not differentiate between the various customer segments. The value proposition, channels and customer relationships are all broadcasted to one main customer segment who are sharing most of the similar needs and problems. As example, the consumer electronics business model. (Osterwalder and Pigneur 2010)

- Niche market

The niche is the very specific type of business, which is presented to very specific type of customers. Business models that target niche markets tend to tailor the value proposition, channel and Customer relationships to the specific targeted audience. This type of business model is usually found in supplier-buyer relationships. (Osterwalder and Pigneur 2010)

- Segmented

The business models which distinctly categorize the targeted audience according to their slight differences of needs and problems are called segmented. For example, the retail section of a bank use to tailor the credit offers according to the customers' possession of assets i.e. a large group of customers who possess assets worth €100,000 and a smaller group of customers who possess assets exceeding €500,000. Both segments have slight differences between their common needs hence the bank's value proposition differs. (Osterwalder and Pigneur 2010)

- Diversified

The diversified business model can be found among organizations that serve two unrelated customer segments having different needs and problems. For example, the Amazon.com cloud computing section that was introduced to Amazon's retail services in 2006 besides the existed retail services. (Osterwalder and Pigneur 2010)

- Multi-sided markets

Multi-sided markets refer to such a business model that is run by an organization, which operates with two or more interdependent customer segments. For example, a credit card company which requires large base of credit card holders and large base of merchants who accept this type of cards. (Osterwalder and Pigneur 2010)

3.7.2. Value Proposition

The value proposition building block indirectly portraits the set of products and services that are capable of creating the desired value for the defined customer segments. In fact, the value proposition is the main reason of redirecting customers from one company to another within the same business niche whereas it solves a

customer's problem or fulfil his needs. The selected set of products or services allows the company to deliver the exact value to the exact segment of its customers hence the value proposition is a fine bundle of benefits that a company or an entity offers its customers. Some value propositions are genuinely new and innovative; others can be similar to other competitive offers in the market with additional leveraging touches. (Osterwalder and Pigneur 2010)
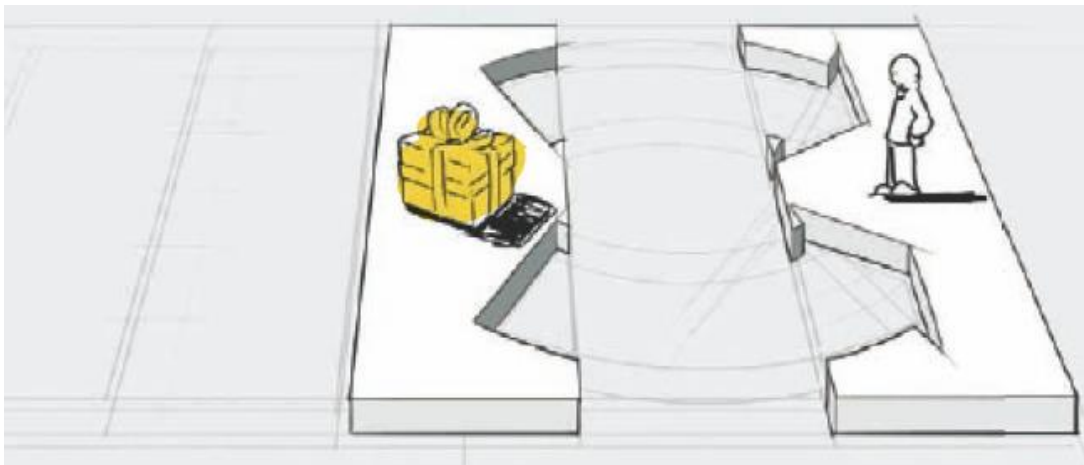
Figure 10. Value proposition building block. (Osterwalder and Pigneur 2010)

Value proposition (value creation) is the result of mixing distinct elements that fulfil the corresponding customer segment's needs. Values can be quantitative such as price, speed of service or they can be qualitative such as design and customer satisfaction. (Osterwalder and Pigneur 2010)

Elements from the following non-exhaustive list can contribute to customer value creation. (Osterwalder and Pigneur 2010)

- Newness

Entities such as technology companies, tend to raise new set of needs that customers previously did not perceive which can be fulfilled by some specific value proposition. For example, a whole new industry was created upon the development of mobile telecommunication. (Osterwalder and Pigneur 2010)

- Performance

Traditionally, improving product or service performance has been an abundant method to create a value. For example, PC (Personal Computer) industry normally relied on this factor by adding more powerful machines to the market. However, improved performance will face a dead end at some point, inevitably. Recently, it is found that faster PCs, larger disk storage space and better graphics have failed to produce a corresponding larger growth in customer demand. (Osterwalder and Pigneur 2010)

- Customization

Value creation can be obtained through tailored products and services to the specific needs of individual customers or customer segments. Recently, mass customization and customer co-creation are key successful factors in value creation.

- Servicing "Getting the job done"

Maintaining the presented services and products for the customer segments is a type of value proposition. For example, airline companies rely entirely on Rolls-Royce manufacturer to manufacture and service their jet engines. This facilitation is considered a new value proposition in itself.

- Design

Design is an important, complex element which is hard to measure. Superior design can leverage a product and vice versa. In fashion industries for instance, design is a main issue of the value proposition.

- Brand

A value proposition can be based on a Brand. Some customer segments may find a value of displaying a specific brand for various deeds e.g. wearing a Rolex watch to display wealth and prosperity or obtaining latest brand models to signify "up-to-date" manners.

- Price

Price-sensitive customer segments tends to obtain similar value at a lower price. It is a common way to satisfy this segment's exact needs, but low-price value proposition

inevitably comes at a cost which affects the business model. For example, business models of low-price airline operators such as EasyJet and Ryanair rely mainly on reducing the price on the account of the quality which facilitates low-cost travelling. Another example is given by the Indian Tata cars. Their products are sold at a very low price which satisfy and fits the characteristics of a wide customer segment of the Indian population.

- Cost Reduction

Helping customers reduce costs is an important way to create value. For example, Salesforce.com offers a hosted Customer Relationship Management (CRM) application which relieves customers from the costs of buying, installing and managing CRM systems themselves hence reduce costs.

- Risk Reduction

Reducing potential risks is a one way to create a value proposition for customers. This is obvious in second-hand cars markets. Offering a one year guarantee creates a value for customers, because it reduces the risk of post-purchase breakdowns and repairs.

- Accessibility

Facilitating the accessibility to customer who previously lacked access to products and services is a way of creating a value. This can be arranged through innovative ideas implemented in the business model, new technologies or a combination of both. For example, using an innovative business model, NetJets company facilitated the concept of fractional private jet ownership. It offers both individuals and enterprises an access to private jets, a service which was previously unaffordable to most customers.

- Usability

Making things easier and convenient to use is a way to create a value. For example, using iPod and iTunes, Apple offered its customers a convenient way to search, buy, download and listen to digital music. Consequently, Apple dominated digital music market.

3.7.3. Channels

The channels building block describes how the organization should communicate and interface with its segments of customers and reach out to them in the appropriate timing for delivering the value proposition. Interfacing with customers includes communication, distribution and sales channels. These interfacings are the touch points with customers, which play a crucial role in improving customer experience. Channels improve numerous functions such as: delivering value proposition to customer segments, raising customers' awareness about the company's products and services, driving customers for correctly evaluating the company's value proposition, facilitate the purchase of certain products and services and providing service-after sales support to customers. (Osterwalder and Pigneur 2010)
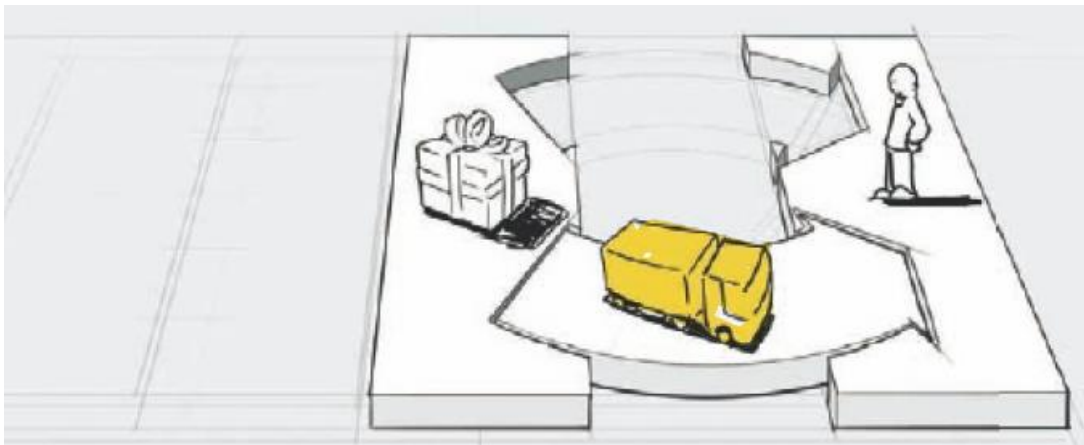
Figure 11. Channels building block. (Osterwalder and Pigneur 2010)

Customer segments are to be reached through channels. Best way to reach customers, the best channel to use, the best time to contact them, the most cost-efficient channel and the integrity between channels can all be determined via the channel phases. (Osterwalder and Pigneur 2010)

Channels have five distinct phases whereas each channel can fulfil one or more of the required phases. Channel classification is shown in Figure 12.

Own channels	• Direct channels • Indirect channels
Partner channels	• Direct channels • Indirect channels
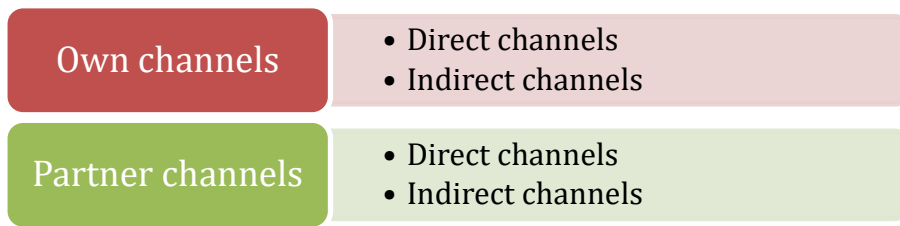
Figure 12. Channel classification.

Table 3 shows the five channel phases related to each channel type.

Channel Types			Channel Phases				
Own	Direct	Sales force	**1. Awareness** Spread and raise awareness about the entity's products and services.	**2. Evaluation** Provide customers with an evaluation method to evaluate the value proposition.	**3. Purchase** Direct customers to purchase specific products and services.	**4. Delivery** Develop a delivery system to deliver the value proposition to customers.	**5. After sale** Provide customer support after purchase.
		Web sales					
	Indirect	Own stores					
Partner		Partner stores					
		Wholesaler					

Table 3. Channel phases and channel types. (Osterwalder and Pigneur 2010)

3.7.4. Customer Relationships

The customer relationship building block states the recommended types of relationships between the organization and each of customer segments for a long-term relation. The organization should clearly set the type of relationship it wants to build with each customer segment ranging from personal to automated relationships. (Osterwalder and Pigneur 2010)

Customer relationship can be driven by three motives such as:

- Customer acquisition
- Customer retention
- Boosting sales or upselling
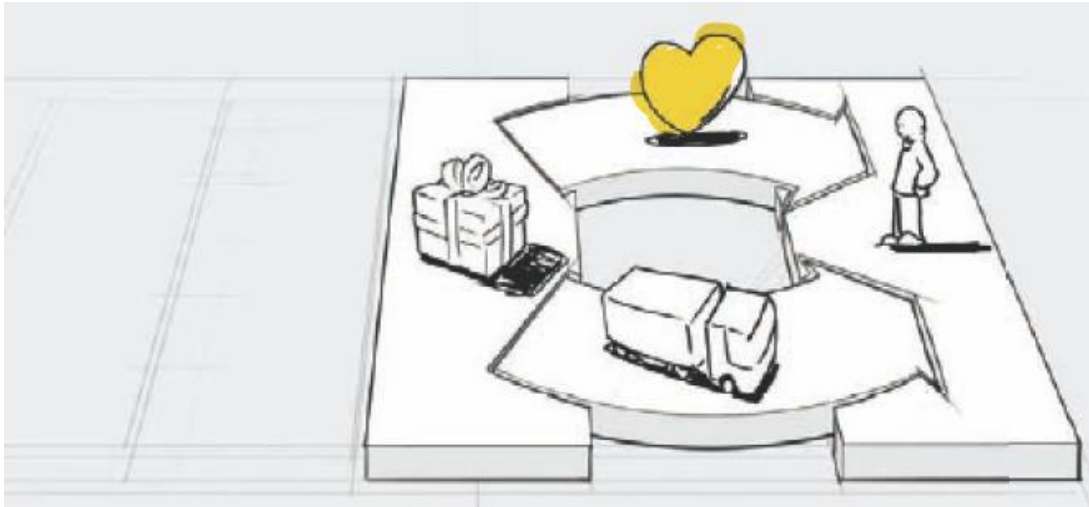
Figure 13. Customer relationship building block. (Osterwalder and Pigneur 2010)

For example, in the earliest days of mobile network operators' era, customer relationships were managed by excessive acquisition strategies that depend on free mobile phones, free subscriptions and gifts. Afterwards, when the market grew saturated, operators turned to focusing on customer retention and increase average revenue per customer. The customer relationship strategy executed by the company or the organization severely affects the overall customer experience. (Osterwalder and Pigneur 2010)

Several categories of customer relationships can be established toward the corresponding customer segment, such as:

- Personal assistance

Personal assistance relationship depends on human interaction between the customer and a customer support representative. The customer support representative's main role is to help the customer during the sales process and after purchase is done. This interaction can take place at the sale site, via call center, email or website. (Osterwalder and Pigneur 2010)

- Dedicated personal assistance

Dedicated assistance relationship is established through a dedicated customer support representative to an individual customer person specifically. It is the most intimate

type of relationships that requires a long period of time to be developed properly. This type is abundant in private banking services whereas high net worth individual customers are appointed a dedicated banker to each one of them for retaining, counselling and promoting bank services. Similar relationships exist in other businesses via account managers whose main role is to establish and maintain a long-lasting personal relationship with valued-customers. (Osterwalder and Pigneur 2010)

- Self-service

In self-service relationship, the entity has no direct relationship with customers. However, the entity provides all necessary means for customers to help themselves. (Osterwalder and Pigneur 2010)

- Automated services

Automated type of relationship integrates a more sophisticated form of self-service with automated processes. For example, the personal online accounts grant customers access to customized services whereas automated services are able to define customer's behavior, characteristics and interests. Consequently, automated services can maintain a personal relationship with customers, tailor specific offers to fulfil their needs and provide recommendations. (Osterwalder and Pigneur 2010)

- Communities

In community relationship, entities utilize user communities to reduce the gap between potential customer segments and the business besides maintaining connection between community members. Modern marketing strategies rely on communities to maximize both reach and revenues. Online communities are the most abundant type of communities. They allow users to exchange knowledge and help to solve their problems. Communities also provide entities with better insights about the characteristics and interests of current and potential customers. (Osterwalder and Pigneur 2010)

- Co-creation

Numerous entities are exceeding traditional customer-vendor relationship by allowing customers to co-create the value proposition. For example, Amazon.com invites customers to write reviews and therefore create value to book readers and

authors. Some companies involve customers in the designing phases of new products or services. Others allow users to create content on the entity's platform for public broadcasting and review. (Osterwalder and Pigneur 2010)

3.7.5. Revenue Streams

The revenue streams building block defines the sources and the amount of cash (money) that the company or organization is expected to get from each customer segment per unit time. The revenue stream is the net profit that is yielded from the process of value proposition i.e. excluding the costs. By analogy, if the customer segment is the heart of the business model then the revenue streams are its arteries. By knowing how much and for how long the customer is truly willing to pay for the value, the organization will be able to successfully generate one or more revenue streams from each customer segment. Each revenue stream may have different pricing mechanism as fixed price lists, auctions, market dependent or volume dependent. (Osterwalder and Pigneur 2010)
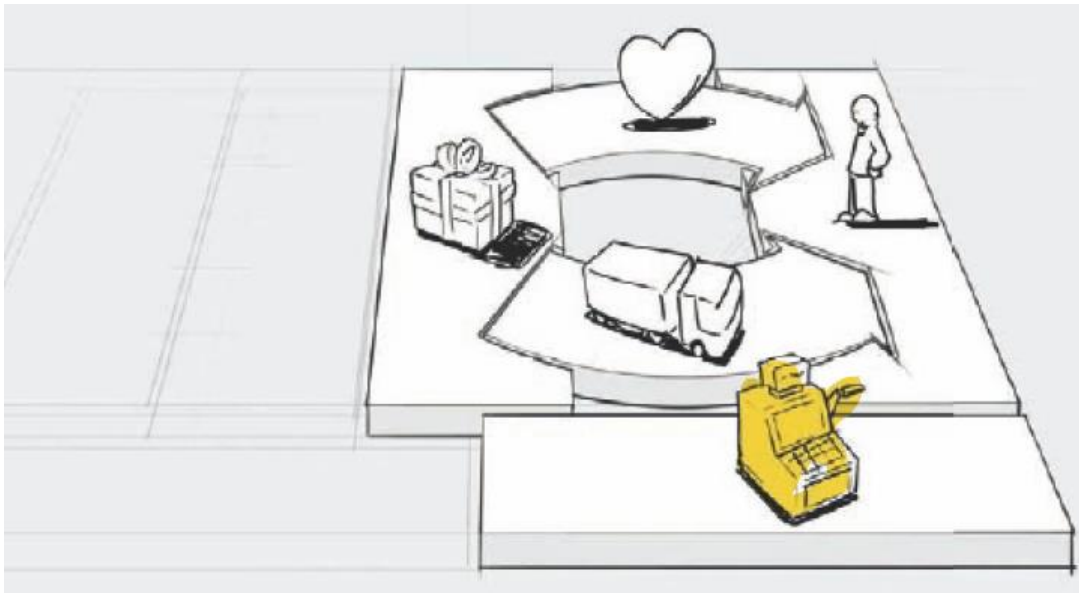
Figure 14. Revenue streams building block. (Osterwalder and Pigneur 2010)

- Types of revenue streams

Two different types of revenue streams can be obtained by the business model:

- **Transaction revenues**: it is the result of one-time customer payments
- **Recurring revenues:** it is the result of regular ongoing payments against value propositions to customer or through providing after-sales customer support.

- Revenue streams generation

Revenue streams are generated through various ways, such as follows:

- Asset sale

Asset sale is the most widely understood revenue stream. It is simply the result of selling ownership rights through physical products like books, music, car models and more.

- Usage fee

Usage fee revenue stream is derived by the use of a certain service. The more the service is used, the more the customer should pay. Telecom operators are the most common example for usage fees as they allow the users to use their network infrastructures and charge them for the time spent in minutes. Another example, hotels, they allow the guests to use their facilities and charge them per unit time spent i.e. per night.

- Subscription fees

Selling the permanent access to a service generates a one revenue stream for the business model. For example, a gym would allow users to access its exercise facilities against monthly or annual subscriptions. This differs from usage fees, users are seeking one-time or several-time usages for the service but on the other hand, in subscription fees, users are regularly using the service.

- Lending/Renting/Leasing

Lending/Renting/Leasing is a temporary revenue stream, which is generated through granting someone the exclusive right to use a particular asset for a fixed duration against a fee. This provides an advantage of recurring revenue for the lender and very beneficial for the renters as they do not have to accommodate full cost. Instead, they enjoy the service of a limited time. For example, Zipcar.com allows customers to rent

cars on hourly basis in Northern American cities. This cemented the concept of car rent rather than car purchase.

- Licensing

Licensing revenue stream is generated by granting the customers a permission to utilize protected intellectual properties against a licensing fee. Licensing make right holders to benefit from their property without the need to manufacture a product or commercialize a service. This revenue stream is very common in media industry whereas content owners reserve the copyrights while selling usage licenses to third parties. Similarly, in technology fields, patent holders permit other companies and organizations the right to use the patented technology against a license fee.

- Brokerage

Brokerage revenue stream results from the intermediation services carried out on behalf of two or more parties. Brokers and real estate agents earn a commission per each successful transaction that matches buyer and seller.

- Advertising

Advertising revenue stream is based on the advertising of a particular product, service or brand. It is a very reliable source of revenue for the media industry. Recently, other sectors, including software industry, started to rely on advertising streams.

- Pricing Mechanism

Each revenue stream has its different pricing mechanism. The type of pricing mechanism used can directly affect the revenue generation. Pricing mechanisms are mainly two types: fixed pricing and dynamic pricing as shown in Table 4.

Fixed pricing		Dynamic pricing	
Predefined prices based on static conditions		Prices change according to market conditions	
List price	Fixed prices for individual products or services	Negotiation	Price negotiated between two or more partners depending on negotiation skills and influence
Product feature dependent	Price depends on the number of value proposition features	Yield management	Price depends on inventory and time of purchase (usually used for perishable resources as hotel rooms and airline seats)
Customer segment dependent	Price depends on the type and properties of the customer segment	Real-time market	Price is established dynamically based on supply and demand
Volume dependent	Price is a function of the quantity purchased	Auctions	Price determined by outcome of competitive bidding

Table 4. Fixed and dynamic pricing. (Osterwalder and Pigneur 2010)

3.7.6. Key Resources

The key resources building block defines the essential assets and infrastructures that are required to run the business model. The resources are helping the organization to create, offer and deliver the value proposition properly. Besides, reaching out to customer segments, maintain customer relationships and earn revenues. Key resources types are various, they are defined according to the type of business. They can be physical, financial or human, can be rented or owned. For instance, a microchip manufacturer requires a large capital for constructing intensive production facilities, but a microchip designer needs are fewer, focusing more on human resources. (Osterwalder and Pigneur 2010)
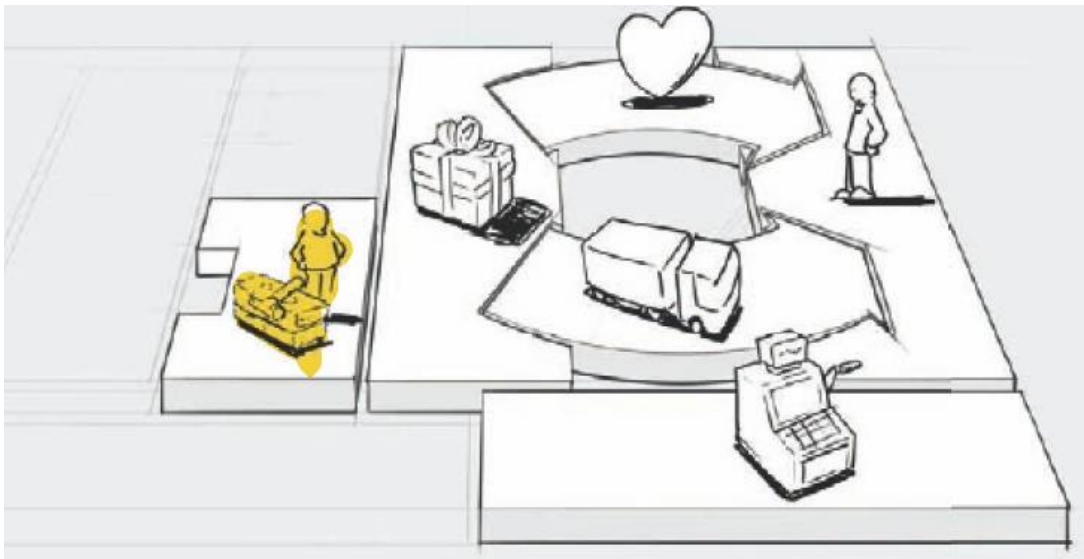
Figure 15. Key resources building block. (Osterwalder and Pigneur 2010)

Knowing the appropriate key resources that the business requires, helps to a plan a successful business model. Key resources can be categorized as follows:

- Physical resources

The physical resources are the assets such as buildings, manufacturing facilities, vehicles, systems, machines, Point-of-Sales (POS) and distribution networks. For example, Wal-Mart retailer mainly relies on physical resources such as global network of stores and related logistics infrastructure whereas Amazon.com retailer relies on extensive IT, warehouses and logistics infrastructure. (Osterwalder and Pigneur 2010)

- Intellectual resources

Intellectual category represents the innovative self-made resources such as brands, slogans, patents and copyrights, proprietary knowledge, partnerships and customer databases. These intellectual resources are the key factors, which make a strong successful business model. They are difficult to develop and require long time periods though when successfully implemented may grant a leveraging value to the business. Consumer companies as Nike and Sony are examples of entities that rely on brand as a key resource. Similarly, Microsoft and Apple rely on software and related intellectual property developed through many years.

- Human resources

Human resources is a crucial factor that is required in every enterprise is the human factor despite the fact that human resources are particularly prominent in certain business models. They are crucial in knowledge-intensive and creative industries as in pharmaceutical companies, which primarily rely on human resources. Experienced scientists, researchers, skilled salespersons and decision-makers are examples of human resources needed. (Osterwalder and Pigneur 2010)

- Financial resources

Some business models facilitate financial guarantees or financial resources, such as cash, lines of credit or stock option pool. Telecom manufacturer Ericsson provides an example of financial resources leverage for the business model. Ericsson tends to borrow funds from banks or capital markets and use a portion of the proceeds to provide vendor financing for their prospective customers to win the orders. (Osterwalder and Pigneur 2010)

3.7.7. Key Activities

The key activities building block includes the most important actions that the organization should carry out to execute its business model. Every business model should have a number of activities to be carried out for successful operation. Similar to key resources, the key activities are required to offer a value proposition and reach out to customer segments. But key activities differ from key resources according to the type of business model. For example, Microsoft Company which is responsible for developing operating systems for PCs, has software development included in its key activities. On the other hand, PC manufacturer Dell has supply chain management included in its key activities. Consultation company like McKinsey can have problem solving included into its key activities. (Osterwalder and Pigneur 2010)
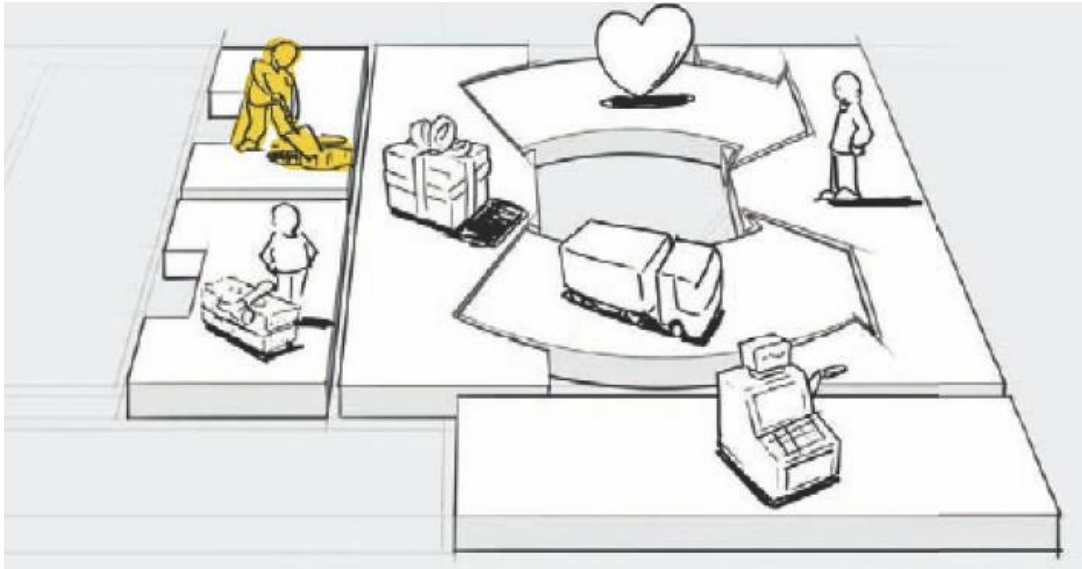
Figure 16. Key activities building block.

Key activities can be classified into:

- Production activities

Production activities are the result of designing, manufacturing and delivering a product or a set of products in mass quantities and suitable quality. Production activities are prevailed throughout business models of manufacturers.

- Problem solving activities

Problem-solving type of activities are characterized by presenting intellectual solutions for customers' problems. Consultancies, Hospitals and design businesses are typical business examples based on problem solving activities.

- Platform/Network Activities

Business models that possess platforms as Key Resource are also driven by platforms as key activities. Networks, matchmaking platforms, software and brands can be platform activities. For example, the business model of the eBay requires a continuous development of its platform: the eBay.com website. Same for Visa's business model with Visa's credit card transaction platform and Microsoft with its operating system platform. Hence, platform management, service provisioning and platform promotion are considered the key activities in this category. (Osterwalder and Pigneur 2010)

3.7.8. Key Partnerships

The partnerships building block highlights the network of business partners such as suppliers and cooperative entities, which help in the realization of the business model. Recently, entities tend to form business alliances to optimize their business models, minimizing the risk and acquire resources.

- Types of partnerships

There can be four types of partnerships:

- **Strategic Partnership** is a partnership between non-competitors.
- **Coopetition** is a strategic partnership but between competitors.
- **Joint Ventures** is an alliance to develop new businesses
- **Buyer-supplier partnership** is the relation established to ensure the flow of supplies
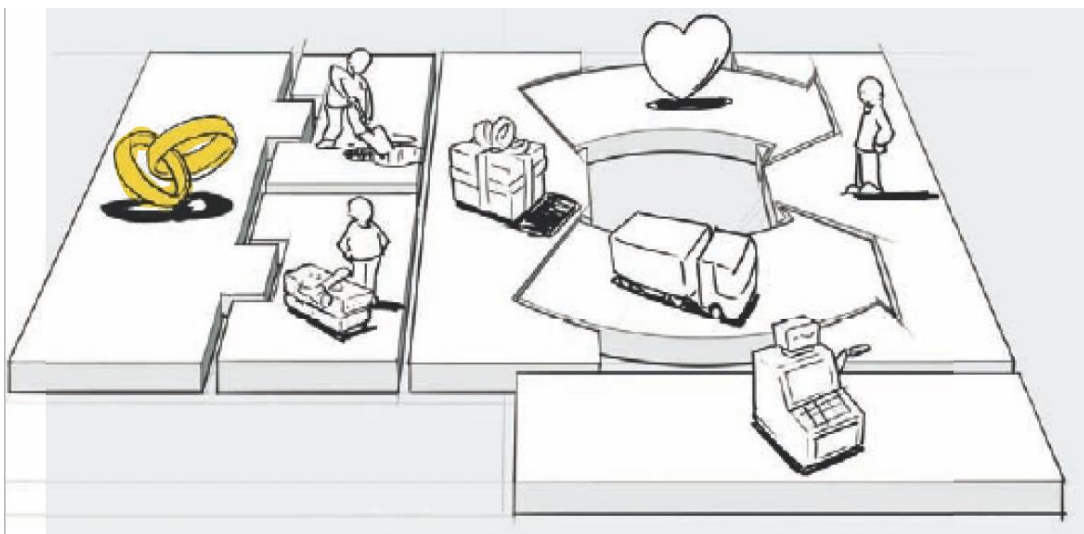
Figure 17. Key partnerships building block. (Osterwalder and Pigneur 2010)

- Key partnerships motives

The three motives for establishing alliances can be viewed as follows:

- Optimization of business models

It can be inefficient for an entity to own all resources by itself. Partnerships between buyer-supplier can optimize the allocation of resources and activities through

outsourcing some business needs and sharing infrastructure. The basic reason for that is to reduce costs. (Osterwalder and Pigneur 2010)

- Minimization of risk

Partnerships can reduce risk in competitive environments which are characterized by uncertainties. Usually, competitors can form partnerships in one specific area and still compete with each other. For example, the Blu-ray disc format is jointly co-developed by a group of world's leading consumer electronics companies. The group cooperated to bring Blu-ray to the market yet individual group members are still in competition in selling their own Blu-ray products. (Osterwalder and Pigneur 2010)

- Acquisition of resources

As stated earlier, entities tend to extend their capabilities by relying on other firms to prepare particular resources or carry out certain activities. These alliances are motivated by needs to acquire knowledge, licenses or access to customers. For instance, smart phone manufacturers can outsource the operating system through licensing rather than developing a specific one to be owned by the manufacturer. (Osterwalder and Pigneur 2010)

3.7.9. Cost Structure

Cost structure is the ninth and the last building block of the Business Model Canvas that states all costs needed to execute the business model. Costs are one of the main drivers for creating and delivering the value, maintaining customer relationships and generating streams of revenues. These costs are normally derived after stating key resources, key activities and key partnerships. (Osterwalder and Pigneur 2010)
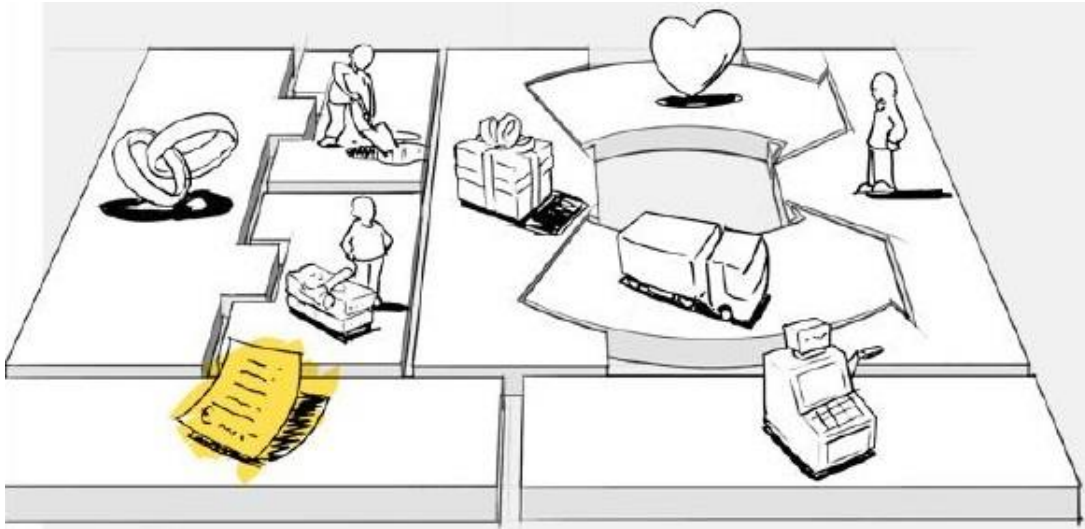
Figure. Cost structure building block.

- Types of business models with respect to cost structure

By default, costs should be subject to reduction at all instants and in every business model. Hence, there are two different types of business models with respect to costs. Business models can be extremely cost-driven such as budget airliners which are built around low cost structures. Others can be value-driven which target to maximize the value. (Osterwalder and Pigneur 2010)

- Cost-driven

Cost-driven models are the business models that focus on minimizing costs on the account of any other elements. That is because the model aims at creating and maintaining the leanest possible Costs Structure using low priced value propositions and extensive outsourcing. In addition, offering the value with minimized prices for budget customers creates a value proposition in itself i.e. the low-priced service with reduced advantages. (Osterwalder and Pigneur 2010)

- Value-driven

Value-driven models are the business model that aim at maximizing the value and its quality regardless any other factors including costs, as some companies are less concerned about costs implications compared to value creation. As examples, premium value propositions and high degree of personalized service usually are

complying with value-driven business models such as luxury hotels with their lavish facilities and exclusive services. (Osterwalder and Pigneur 2010)

- Characteristics of cost structures

- Fixed costs

The fixed costs are the costs that always remain constant despite the number of services or activities offered. Such as salaries, rentals and fixed assets. Fixed costs can be very large in certain industrial areas such as in manufacturing industry. (Osterwalder and Pigneur 2010)

- Variable costs

Variable costs change proportionally with the volume of services or activities offered such as the annual or monthly budget appointed for purchasing new assets. For example, music festivals that are often characterized by high variable costs. (Osterwalder and Pigneur 2010)

- Economies of scale

When a business output increases, cost advantages arise and that is the economies of scale. For example, when a large company benefits from lower bulk purchase rates. In other words, when the average cost per unit decreases, then the business output or sales increase. (Osterwalder and Pigneur 2010)

- Economies of scope

When the company decides to undergo scope's expansion it adds more operation to provide extra products using the same assets that is the economies of scale. It usually occurs in large enterprises. For example, same marketing activities or distribution channels are used to support multiple products hence the average cost per unit drops as well. (Osterwalder and Pigneur 2010)

4. BUILDING NTC BUSINESS MODEL CANVAS

NTC is the acronym for Nordic telemedicine Center, which is established in a joint project between Finland and Sweden. The area of operations is the Bothnia region found in both countries. The main administrative regions in Finland are the Vaasa region (Pohjanmaa) and the South Ostrobothnia region (Etelä-Pohjanmaa), In Sweden; the main region is the West Bothnia (Västerbotten).

4.1. Customer Segments

The Nordic telemedicine center has three physical locations called physical nodes, one is located in Seinäjoki (Finland) and two nodes are situated in Umeå (Sweden). These nodes are established to operate within the two regions of both partner countries, South Ostrobothnia (Finland) and West Bothnia (Sweden). Customer segmentation building block of the NTC Business Model Canvas is coinciding with the Diversified business model described in Chapter 3, because the Telemedical center is dealing with distinct groups of customer segments that have different needs and different problems e.g. monitoring vital signs of elderly patients with chronic diseases, providing consultancy and training to medical institutions' students. In other words, the Telemedical center serves medical monitoring services to healthcare professionals and patients, testing and training plus consultancy to other entities or individuals. Inside the patients' (Civil society) customer segment, customers can be further segmented according to their age structure because the services which are offered to elderly people differ from the services offered to children and so forth. Not only targeting healthcare professionals and civil society are sufficient but in NTC the target group can be extended to include also academic staff, researchers, enterprises and municipalities.

Accordingly, customer segments can be categorized into:

- Academia
- healthcare professionals
- Industry (Enterprises)
- Municipalities

- Civil society

The previous customer segments classification covers almost all types of prospective customers that are subject to the value proposition presented by NTC. Sections 4.1.1, 4.1.2, 4.1.3, 4.1.4 and 4.1.5 include the results of the conducted study within both regions in Finland and Sweden to estimate the targeted group of each segment, in approximated numbers using governmental statistics and some computations.

4.1.1. Academia

As a customer segment, academia refers to the academic-oriented prospective customers. Academia includes university staff, researchers and higher university degree students who are interested in NTC value proposition.

- Size of academia

In order to calculate the percentage of the prospective academia customers in both regions of operation i.e. which are South Ostrobothnia (Finland) and West Bothnia (Sweden), the following keywords are being used to extract the required academia statistics from Finnish and Swedish annual governmental statistics, Tables 5 and 6 show the results:

Categories (South Ostrobothnia)	Men	Women	Total
23 Teaching professionals (Level 2)	1102	3154	4256
231 University and higher education teachers (Level 3)	76	111	187
232 Vocational education teachers (Level 3)	263	241	504
235 Other teaching professionals (Level 3)	294	835	1129
Total	1735	4341	6076

Table 5. Academia statistics in South Ostrobothnia County, Finland. (Statistics Finland 2015)

Result: There are 6,076 persons referred to as 'Academia' in the region of South Ostrobothnia in Finland.

Categories (West Bothnia)	Men	Women	Total
2311 Professors	274	164	438
2312 University and higher education lecturers	350	271	621
2313 Research assistants	19	33	52
2314 PhD Students	407	382	789
2319 University and higher education teachers not elsewhere classified	245	246	491
2320 Vocational education teachers	228	146	374
2351 Special teachers and special needs teachers	65	427	492
2359 Teaching professionals not elsewhere classified	165	202	367
Total	1753	1871	3624

Table 6. Academia statistics in West Bothnia County, Sweden. (Statistics Sweden 2016)

Result: There are 3,624 persons referred to as academia in the region of West Bothnia in Sweden.

The percentages of academia with respect to the total population are approximately equal; 3.2% in South Ostrobothnia and 1.4% in West Bothnia.

- Characteristics of academia

Academic staff and researchers are characterized by being punctual, very specific and formal. They are mostly interested in things that are related to their academic and research scopes. Furthermore, they are in a continuous search for new and innovative ideas. That reflects on their personality and lifestyle hence the way of marketing NTC activities to this group of customers should comply with the same traits.

4.1.2. Healthcare Professionals

The healthcare professional customer segment is referring to the professional persons who are working within healthcare and welfare sections such as medical doctors, personal care workers, physicians, nurses and pharmacists.

- Size of healthcare professionals

To gather the required information about the size of targeted healthcare professionals' customer segment in both countries, the following keywords are used and Tables 7 and 8 show the results:

Categories (South Ostrobothnia)	Men	Women	Total
22 Health professionals (Level 2)	311	697	1008
221 Medical doctors (Level 3)	213	245	458
222 Nursing and midwifery professionals (Level 3)	17	195	212
226 Other health professionals (Level 3)	68	220	288
32 Health associate professionals (Level 2)	334	3312	3646
321 Medical and pharmaceutical technicians (Level 3)	33	427	460
322 Nursing and midwifery associate professionals (Level 3)	155	2364	2519
323 Traditional and complementary medicine associate professionals (Level 3)	1	7	8
325 Other health associate professionals (Level 3)	134	487	621
532 Personal care workers in health services (Level 3)	434	4475	4909
Total	1700	12429	14129

Table 7. Healthcare professional statistics in South Ostrobothnia, Finland. (Statistics Finland 2015)

Result: There are 14,129 healthcare professionals in the region of South Ostrobothnia in Finland.

For Sweden, Table 7 shows the population categories in West Bothnia.

Categories (West Bothnia)	Men	Women	Total
1511 Clinical and operations managers in health care, level 1	37	64	101
1512 Department and unit managers in health care, level 2	47	239	286
2181 Environmental and occupational health and hygiene professionals	21	23	44
2182 Environmental and occupational health inspectors	34	67	101
2211 Specialist physicians	375	353	728
2212 Resident physicians	136	172	308
2213 General medical practitioners	45	68	113
2219 Other physicians	134	153	287
2221 Professional nurses	217	1255	1472
2224 District nurses	11	251	262
2225 Psychiatry nurses	29	90	119
2226 Nurses - Ambulance	33	22	55
2227 Nurses - geriatric	53	405	458
2228 Nurses - Intensive care	35	132	167
2231 Nurses - operation	16	99	115
2232 Nurses - children	6	95	101
2233 Nurses - school	2	85	87
2234 Company nurses	3	20	23
2235 Nurses – radiology and other specialist nurses	60	322	382
2272 Physiotherapists and occupational therapist	130	553	683
2281 Pharmacists	2	61	63
2283 Audiologists and speech therapists	2	62	64
2289 Health professionals not elsewhere classified	14	39	53
3424 Wellness consultants and health educators	5	14	19
5349 Personal care workers in health services not elsewhere classified	78	189	267
Total	1525	4833	6358

Table 8. Healthcare professionals statistics in West Bothnia, Sweden. (Statistics Sweden 2016)

Result: There are 6,358 healthcare professionals in the region of West Bothnia in Sweden.

The percentages of healthcare professionals with respect to total population in both regions are approximately equal; 7.4% in South Ostrobothnia and 2.5% in West Bothnia.

- Characteristics of healthcare professionals

Nordic healthcare professionals are characterized by proficiency, occupancy and decency. Most of the time their schedule is congested with fixtures. Yet they are very much interested to check new technological solutions that can be adopted into the medical and healthcare fields. Therefore, reaching out to this type of customers should be either through their working institutions or by private contact upon prior request.

4.1.3. Enterprises

Enterprises customer segment represents the corporate type of customers that can potentially benefit from NTC activities and services. In the long run, these enterprises can be more likely to become future partners.

- Size of Enterprises

The numbers of existing enterprises in each region are described in Table 9.

	South Ostrobothnia	West Bothnia	Total
Total number of enterprises (All fields of industry)	43215	37740	80955
Number of enterprises (Healthcare industry only)	551	672	1223

Table 9. Enterprises statistics in South Ostrobothnia and West Bothnia. (Statistics Finland 2013) and (Statistics Sweden 2015)

Result: There are 551 healthcare enterprises in the region of South Ostrobothnia in Finland and 672 in the region of West Bothnia in Sweden.

The percentage of the operational healthcare enterprises with respect to the total number of enterprises within all fields of industry in both regions are approximately 1% of enterprises in each region.

- Characteristics of healthcare enterprises

Nordic countries are characterized by welfare and high-quality healthcare. For that, they assign large expenditure towards healthcare that grows steadily every year. Hence, it is normal that the number of enterprises that are interested in healthcare industry grows proportionally to the assigned expenditure as well. Moreover, small-sized startups are founded to serve the same scope eventually that widens the technological innovative solutions scope by the same pace.

4.1.4. Municipalities

In Finland, there are 17 municipalities within the South Ostrobothnia region. They are: Alajärvi, Evijärvi, Lappajärvi, Vimpeli, Alavus, Kuortane, Soini, Ähtäri, Ilmajoki, Kauhava, Kurikka, Lapua, Seinäjoki, Isojoki, Karijoki, Kauhajoki and Teuva.

On the Swedish side, there are 15 municipalities within West Bothnia region. They are: Åsele, Bjurholm, Dorotea, Lycksele, Malå, Nordmaling, Norsjö, Robertsfors, Skellefteå, Sorsele, Storuman, Umeå, Vännäs, Vilhelmina and Vindeln. Moreover, the decision makers are usually the country council staff.

- Characteristics of municipal administrations

Decision makers at municipalities are governmental representatives who are responsible for carrying out their municipalities (cities) affairs, to ensure the order, prosperity and welfare of the region. Thus, they are highly interested in conducting useful activities that will result in welfare and overall development of their area of operation. Since NTC services and activities are matching that scope, therefore contacting municipal decision makers for partnership is crucial and should be done in a professional and formal way.

4.1.5. Civil Society (Mass Market)

Civil society customer segment refers to all population with all its diverse categories and age structures within the two regions. Indeed, not all population is targeted, but specific age groups with certain characteristics are among the interests of NTC, such as elderly people and pediatrics.

- Size of civil society

The statistics shown in Table 10 and Figure 18 are portraying the population categories of both regions. By utilizing them, customer segmenting can be more realistic and revenue verses cost calculations are becoming more legit.

Age group	South Ostrobothnia		West Bothnia		Category
	Men	Women	Men	Women	
0-4 years	5241	5080	7667	7084	Pediatric
5-17 years	14989	14166	19561	18633	Underage
18-54 years	41439	38496	66105	61213	Adults
55-64 years	13883	13614	15812	15647	Older adults
65-99 years	19913	24994	26575	29938	Elderly people
100- years	12	33	7	36	
Total	95477	96383	135727	132551	
Total per region	191860		268278		

Table 10. Age structures of South Ostrobothnia and West Bothnia populations. (Statistics Finland 2017) and (Statistics Sweden 2017)

Result: shown in Figure 18.

South Ostrobothnia

5%
15%
24%
14%
42%

■ Pediatrics   ■ Underage   ■ Adults   ■ Older adults   ■ Elderly people

West Bothnia

6%
14%
21%
12%
47%

■ Pediatrics   ■ Underage   ■ Adults   ■ Older adults   ■ Elderly people
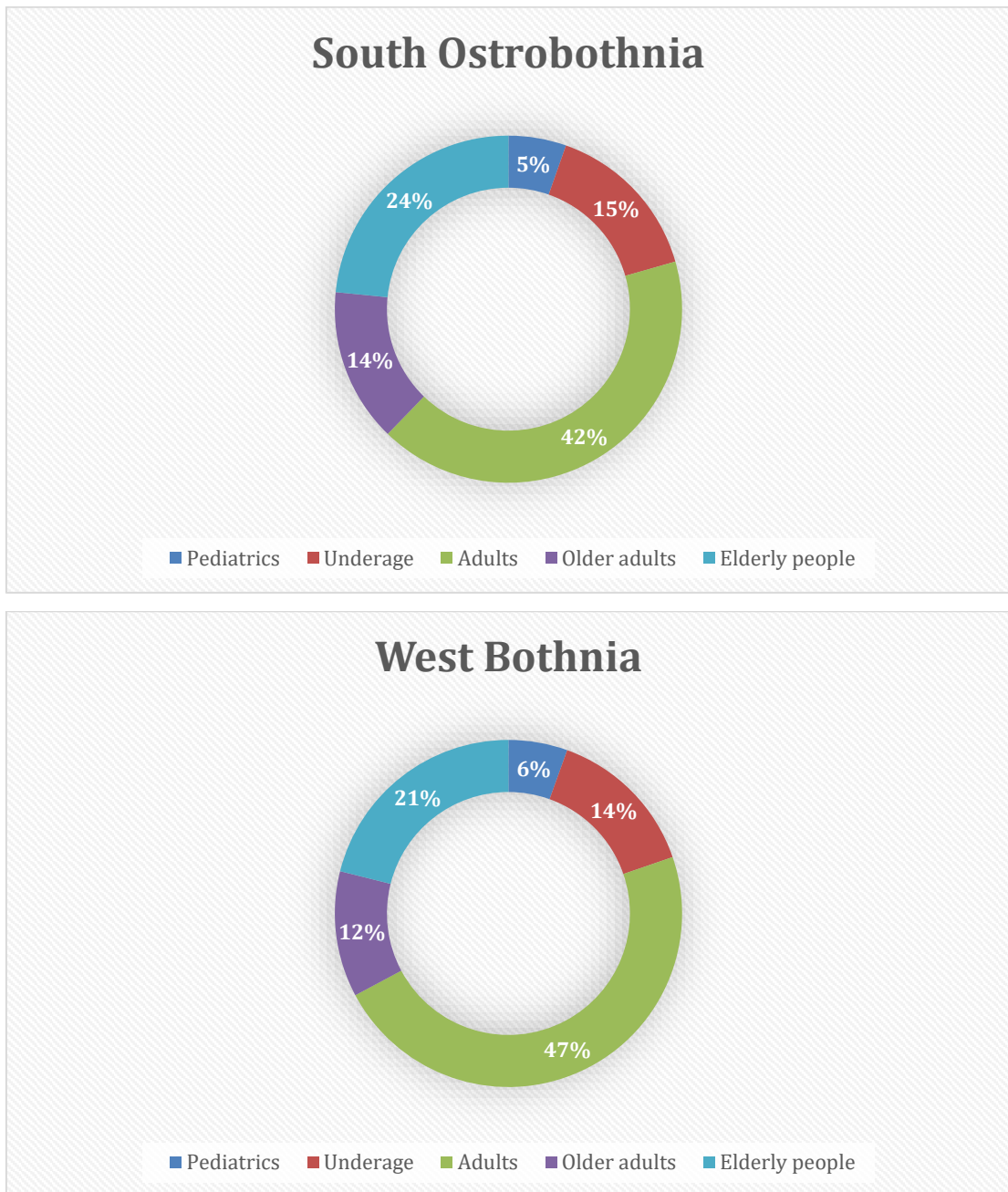
Figure 18. South Ostrobothnia and West Bothnia population age groups

Both charts are approximately similar. The percentages of elderly people who are exceeding 65 years old are quite high, 24% in South Ostrobothnia and 21% in West Bothnia. Meanwhile, percentages of children and infants who can be referred to as pediatrics are 5% and 6% respectively.

- Characteristics of civil society

- Entire population

Both regions have some common insights about the structure and characteristics of the population. In South Ostrobothnia, Finnish language is the most spoken language across the region. As a consequence, all NTC publications and marketing campaigns within the region should be primarily in Finnish language. Respectively, in West Bothnia, Swedish language is the most spoken language in the region. Therefore, it is recommended to carry out NTC activities, marketing campaigns etc. primarily in Swedish. Moreover, since English is widely spoken in both countries, it can be considered while marketing to international residents. Both Finnish and Swedish citizens' daily routines are quite recursive and punctual so that NTC marketers should specify best timings, ways and places to inform them about NTC activities.

- Pediatrics

Pediatrics is the title shortened for medical major or specialists who operate on children aged from zero to 4 years old. Infants during delivery can experience birth complication as it was recorded that nearly 1% of infants need support because of complication. Sweden and Denmark are the Nordic Countries with the largest percentage of autism. It was found that nearly 72 out of 10,000 of children from pediatric age group are autistic in Sweden while the ratio is decreased to 68 in Denmark making them the 3rd and the 4th countries with highest rates of autism worldwide (WorldAtlas.com, Rolando Y. Wee April 2017). In Finland, nearly 3 out of 96 children from pediatric age group succumb to death suffering from childbirth complications, neonatal problems or skeleton impairments that require special and emergent medical attention. NTC services include childbirth complications emergency support and can be extended to cover other pediatric urgent situations.

- Elderly people

Among different age groups, the elder people need special care most often. Especially, elderly people with chronic diseases and memory disorder require regular monitoring and continuous medical attention. It was found that in 2015 in South Ostrobothnia region, nearly 333 nearly 333 out of 2,155 deaths are caused by

dementia and 65 deaths caused by accidental falls. That are almost 15.5% and 3% of deaths are because of dementia and accidental falls respectively as these causes are abundant in elderly people. Furthermore, according to Statistics Finland in 2013, 2% of people aged 65 – 74 years old had difficulties in getting into and out of bed and 6% had difficulties to move outdoors. Moreover, 11% of Women aged 75 – 84 years old had difficulties in getting into and out of bed and 25% had difficulties to move outdoors.

4.2. Value Propositions

NTC as a telemedicine center project was established to serve a main value of improving healthcare and welfare of the civil society in the targeted research region. Starting from that main mission of the project, NTC value propositions can be further broken down into four values to be served to the society, as follows:

- Education and awareness
- Providing telemedical solutions
- Guidance and consultancy
- Facilitation and catalyzing innovation

4.2.1. Education and Awareness

Education and awareness is the value proposition with main goal to inform healthcare individuals and civil society people about the NTC technologies. Education and awareness can be delivered through conducting regular seminars and courses. The value proposition of education and raising awareness should be a recurring and a continuous long-term process carried out by the center regularly to spread the telemedical knowledge and raising awareness about the risks of exposing people with chronic diseases to an unmonitored daily life. Especially the elderly ones.

4.2.2. Providing Telemedical Solutions

Providing telemedical solutions value proposition aims at serving the qualified tested telemedical solutions to enterprises and individuals alike. Each of the NTC physical nodes have showroom, that consists of tested homecare equipment and monitoring devices. Enterprises that operate in the regional healthcare industry can utilize NTC

to incubate and develop further the telemedical services they are planning to offer to their own clients. In addition, they can use the center's virtual telemedicine network to establish a communication between medical institutions, patients and vice versa. The same applies for civil individuals who can use center facilities to conduct a virtual medical visit or purchase telemedical monitoring devices.

4.2.3. Guidance and Consultancy

Guidance and consultancy value proposition is an intellectual yet a non-tactile value, for it aims at serving the telemedical experience in forms of guidance and consultancy to beneficiary customers. Enterprises, entrepreneurs and healthcare startups can consult with NTC experts and IT technicians to gain experience about eHealth service delivery, matching devices and equipment, expected costs and revenues, dealing with different customer attitudes and managing the center facilities. Hence, consultancy beneficiary customers can adjust their business models accordingly.

4.2.4. Facilitation and Catalyzing Innovation

Facilitation and catalyzing innovation value proposition is another intellectual value, which aims at facilitating the means of telemedicine connection between beneficiary customer segments and the destination nodes. This involves leasing the virtual telemedicine network asset to beneficiary customers and Hospitals' hubs in order to facilitate the connection between patients and their healthcare persons. Also catalyzing innovation through offering NTC information technology assets, such as the tested devices and equipment, can help the co-realization of innovative ideas and services.

4.2.5. NTC Value Proposition Characteristics

The previous NTC value propositions are perfectly matching the value's elements, which should exist in the successful value proposition building block of the canvas. They are a fine mix of distinctive values, which contain a set of quantitative and qualitative elements.

- Quantity vs quality

  NTC services that are made upon the NTC value proposition are delivered with affordable prices thus, quantitative element is present. In addition, numerous telemedical solutions are also present within the NTC nodes which are another type of the quantitative element. Whereas education, consultancy, facilitation and serving telemedical solutions are fulfilling the qualitative element.

- Newness

  NTC values are clearly a modern set of innovative ways which are able to overwrite traditional ways of treating special chronic disease holders. Monitoring devices and homecare equipment can be used to improve the quality of the overall health vital signals and reduce potential health threats.

- Performance

  The technological devices present in NTC physical nodes are continuously updated and tested to ensure best performance and better measurements. Besides, the performance of the virtual telemedical network is evaluated by the IT technicians to avoid disconnections and delays.

- Customization

  Values are customized around the cornerstone goal of NTC, which is delivering telemedicine concept to individuals and organizations alike. They are such special and non-vague values that can only be offered by entities as NTC physical nodes.

- Servicing

  Telemedicine network assets and homecare smart devices are regularly tested and calibrated by NTC physical node technicians in order to maintain accurate readings. Service-after-purchase is also offered to customers buying NTC products.

- Design

  NTC virtual network infrastructure should be designed to meet the required KPIs (Key Performance Indicators) such as high throughput, low congestion, minimal delay and high efficiency. All network nodes should be monitored during the uptime of operation and diagnosed during the off time.

- Price

  Initially, NTC services should be offered with a marginal profit to keep the balance between costs and revenues. The main goal of NTC is to spread telemedicine concept among the civil society hence exaggerate profits are out of scope.

- Risk reduction

  Customer privacy is a paramount security concern in NTC. Assurances and security measures should be guaranteed yet exhibited to customers in order to gain more customer trust.

- Cost reduction

  NTC services should satisfy customer's needs by lowering expected costs. Helping customers to reduce their costs and facilitate their daily routine without quality attenuation are considered a total success in delivering the value.

- Usability

  Facilitating the ease of using network and homecare devices is one edge of NTC values. Users will be offered a hands-on training on devices and how to use them.

- Accessibility

  Accessibility is one of the main concerns for NTC virtual network. Granting network access to customers who are in-use of the network and facilitating their surfing are points of strengths that should characterize NTC.

4.3. Channels

Each customer segment has its own targeting channel that may intersect with the rest. Initially, the majority of NTC channels are expected to be so-called owned channels. Eventually, by the time when more partners are acquired into NTC, the length of the indirect channels will increase as well.

4.3.1. Channels per Customer Segment

- Academia

    Teaching staff, researchers and University professors can be notified about NTC services through emails, over the phone or by official private contact from NTC public relation manager. NTC partners can contribute in acquiring academia customers using their publications, word of mouth and newsletters. Nevertheless, after reaching initial agreement, academia customers should be invited to NTC premises for a live demonstration in the corresponding showroom. Hence, generating academia leads i.e. can be re-contacted again in the future for new services.

- Healthcare professionals

    Professionals who are working within the healthcare and welfare sectors can be targeted by sending center publications or brochures to the targeted healthcare institutions, by emails, over the phone or by official private contact from NTC public relation manager. The latter is usually encountered when contacting higher managerial levels of healthcare professionals. Eventually, it is necessary to conduct regular group exhibition events in NTC showrooms to inform the guests about NTC activities. Moreover, medical staff is subject to be invited to NTC courses and seminars regarding telemedicine. Partners can contribute in acquiring healthcare professionals using their contacts database, publications, word of mouth and newsletters.

- Enterprises

    Companies, institutions and organizations are often preferably contacted using official approach from the entity's public relation manager which should be the same for NTC as well. Yet, startups and small-sized companies or organizations can be approached using the basic types of communication i.e. through email, phone calls and publications. NTC partners can help in approaching some targeted enterprises in the region through their communication teams and contact databases.

- Municipalities

    Decision makers in the regional municipalities' administration are recommended to be contacted solely via official contact from NTC public relation manager.

Municipalities are very essential potential customers who can be turned to partners and vice versa.

- Civil society

Common population and individuals are subject to acquisition through all means of communications. There should be a vast email database collected through online and onsite means for the interested individuals. Onsite info desks containing NTC publications should be regularly organized in areas of targeting such as welfare and healthcare institutions. NTC web portal should contain an embedded web-store for direct purchase of devices online and the customer contact details should be stored in a retargeting list. NTC partners can easily induce the concept and center operations to individuals by producing publications and the word of mouth. By doing so, they simultaneously advertise the center for potential customers.

Table 11 demonstrates the types of NTC channels that are expected to be established with the corresponding customer segment.

Customer segment	Own/Partner channel	Direct/Indirect channel	Touchpoint
Academia	Own channel	Direct channel	Services over Email/Phone
	Own channel	Direct channel	Public relation manager
	Partner channel	Indirect channel	Newsletter/Publications
healthcare professionals	Own channel	Direct channel	Services over Email/Phone
	Own channel	Direct channel	Own publications
	Own channel	Direct channel	Public relation manager
	Partner channel	Indirect channel	Newsletter/Publications
Enterprises	Own channel	Direct channel	Services over Email/Phone
	Own channel	Direct channel	Public relation manager
	Partner channel	Indirect channel	Newsletter/Publications
Municipalities	Own channel	Direct channel	Public relation manager
Civil society	Own channel	Direct channel	Mailing list
	Own channel	Direct channel	Web store
	Own channel	Direct channel	Info-desks
	Partner channel	Direct channel	Partner own stores
	Partner channel	Indirect channel	Partner's partner stores

Table 11. Expected NTC channels for each customer segment.

4.3.2. Channel Phases

The proposed NTC draft channels with the corresponding customer segments comply with the business model Canvas requirements for a successful channels building block. Each suggested channel meets most of the five phases that should be encountered in the established channel.

- Awareness

All channels contribute in raising customer awareness about NTC. For the basic communication means, customers are informed briefly via email or phone call about NTC concept, services and activities. The contact person or NTC representative should have suitable communication skills to deal with each corresponding customer segment in order to deliver the required message professionally. Written web content through NTC website and email messages should be instructed by professional content writers and SEO (Search Engine Optimization) editors so that NTC services and activities can appear among the earliest results when customers use online search engines to look for the same matched keywords with NTC. Newsletters should contain rich content showcasing NTC activities, services, latest technologies and upcoming events so that the reader can gain an overview about the telemedicine concept hence the possibility to get new customers. There should be a guideline document that can be shared with NTC partners to unify the style of all NTC documents. Info desk representatives and NTC public relation managers should be trained to solidly understand the main scope of the center, type of services it offers and be ready to answer customer inquiries.

- Evaluation

Comments, positive and negative feedback opinions are all essential for the evaluation process. NTC proposed channels are diversified and most of them offer evaluation methods for the corresponding customer segment. Online NTC portal should contain a specific feedback section to collect online visitors' opinions about the services and activities. Customer, who are targeted though the mailing list, should find a hyperlink that refers to NTC feedback section in the email message footer. Certain segments of customers, such higher managerial healthcare professionals, can be contacted privately for acquiring their feedback solely. Newsletters and info desk brochures are recommended to have a one-page feedback form to be filled by the attendees after being informed or introduced to the NTC showrooms. Same applies to the phone call channel; customers can be re-contacted after they have subscribed to or purchased NTC services to inquire about their feedback. Larger entities usually do the same whereas an AVR (Automated Voice Response) call can be sent to customers to ask

for their NPS (Net Promoter Score) in which the customer listens to the voice recorded question and give a 0-5 rating using the phone keypad. NTC partner can be asked to conduct same feedback process with their touchpoints with customers as well then later be delivered to NTC management. It is highly advised to adjust each feedback form to the corresponding customer segment i.e. not only a single unchanged form for all.

- Purchase

Raising customer awareness process usually followed by the Call to Action (CTA) stage. Customers should be gently redirected to act based on what information they have already received about NTC scope. The call to action can vary from one customer segment to another. academia and healthcare professionals can be asked to register for seminars or demonstrations for more practical enrichment, civil individuals can be redirected to purchase NTC products, enterprises should be asked to subscribe in the linked virtual telemedicine network and finally municipal decision makers can be asked for further step towards funding, mutual collaboration or partnership. CTAs are recommended to be included in all customer channels established by NTC so that customers at all levels and channels will be induced to take further action towards the purchase stage.

- Delivery

Each customer channel touchpoint should state clearly how the beneficiary customer will receive the value proposition. Written content should include a statement about the delivery method of products and services for example homecare devices delivery and the estimated time of arrival. Same applies for verbal communications, public relation managers, showroom officers and info desk representatives should inform the corresponding customer segment about the way of delivery and the expected time duration. Other non-tangible services and activities delivery such as seminars, courses, exhibitions and demonstrations can be explained thoroughly to the beneficiary customer segment via all channels.

- After sales

Customer support after purchase is one key factor for maximizing revenues. Because customers who have purchased or subscribed in NTC activities and services are more likely to redo it again, the post-sale support is important. Testing, calibration and technical support for NTC devices can be offered to customers who purchased homecare devices. This activity can be done via basic communication means or onsite. The same applies for non-tangible services as customers can be retargeted in other services that already matched the previous services they purchased before. Hence, customers would consider the received recommendations because they are already matching their topics of interest.

4.4. Customer Relationships

Maintaining long-term relationships with customers is an efficient way to increase the ROI (Return on Investment). NTC should establish durable customer relationships with each corresponding customer segment. There is a difference between channels and relationships. Channels provide the way to communicate for NTC and its customers. Relationships are used by NTC to keep the existing customers and to generate new customers. Recommended customer relationships that should be linked to each segment are shown in Table 12.

4.4.1. Relationships per Customer Segment

- Academia

Researchers, PhD students and university staff should be invited to a professional NTC community established online. This community can be created on an online professional network such as LinkedIn. The importance of this community lies on the continuous posting of NTC latest updates and announcements so that academia customers can easily check them in their own homepages. Automated NTC website service can also be used to recommend and facilitate NTC services and activities via automated email updates to the vast majority of academia people. Moreover, higher managerial levels of academia are recommended to be regularly informed about NTC updates through a dedicated NTC personal assistant. It is found that having a certain

unchanged contact person bestows a more solid customer retention and trust upon the relationship with higher managerial level and better results.

- Healthcare professionals

  Healthcare professionals customer segment covers more focused target group than academia. As a consequence, it requires extra types of relationships. The vast majority of healthcare professionals are subject to retention through online professional community, NTC automated service and personal assistance via the basic means of communications. Updates, activities and new services should be regularly fed to NTC online community so that customers are kept within a certain knowledgeable level about the centers activity. Experienced healthcare professionals should be regularly invited to co-create mutual activities such as courses or seminars at NTC premises. In addition, dedicated personal assistance should be appointed to higher managerial levels of healthcare professionals for the same reason stated previously.

- Enterprises

  Corporates tend to appoint certain contact person for each activity, that's why others should comply with the same method. NTC should maintain a continuous relationship with potential enterprises via the dedicated personal assistance. Enterprises are subject to be asked for a co-creation relationship to mutually create a common value proposition. New small-sized startups and entrepreneurs are recommended to be invited to NTC professional online community for continuous newsfeed provision about the center.

- Municipalities

  Decision makers and administrators at the regional municipalities and county councils are advised to be retained to the center via co-creation. In this case, NTC dedicated personal assistant can be the same as the public relation manager because it is the same job description of both positions to maintain the relationship with county's officials. Municipalities should be continuously notified about latest NTC updates so that the communication with them remains active.

- Civil Society

Common population is the largest targeting group among NTC customer segments. Therefore, there are five possible customer relationships types can be established with the civil society. Customers can easily enroll in the NTC online community, purchase using self-service section and get informed about the new activities by using the automated web service. Besides, customers can be retained through NTC personal assistance support. There can be dedicated personal assistance support for special subtypes of individuals such as pediatrics and elderly people with chronic diseases.

Customer segment	Relationship
Academia	Dedicated Personal Assistance
	Community
	Automated Service
healthcare professionals	Personal Assistance
	Dedicated Personal Assistance
	Co-creation
	Community
	Automated Service
Enterprises	Co-creation
	Dedicated Personal Assistance
	Community
Municipalities	Co-creation
Civil society	Self-service
	Automated Service
	Community
	Personal Assistance
	Dedicated Personal Assistance

Table 12. NTC proposed customer relationships for each customer segment.

4.5. Revenue Streams

The estimated revenue streams out of NTC activities are expected to be handful in the earliest stages of applying the business model. In value-driven cost structure like NTC model, the main focus is having a marginal profit versus total costs because the value proposition is the cornerstone of the NTC foundation. Securing the minimal required costs to run the center through revenue streams is the main paramount importance. Consequently, marginal profits can be applied for the greater good to both, NTC and customers. When customers get NTC value propositions with affordable prices, this is considered another value proposition in itself as stated earlier. The amount, type and recurrence of NTC activities or services will determine the main bulk of the expected revenue streams. Based on performed pilots and questionnaires, pricing pattern should be estimated within an acceptable level of profit i.e. to be more than the calculated costs and less than the expensive criterion. These criteria can also be manipulated using pilots and questionnaires. The ultimate goal should be covering the costs, maintain the quality of service (QoS) and maximizing the profit without price exaggeration.

As discussed earlier in Chapter 3, there are two types of revenues; recursive and transaction revenues. The recursive ones are the paid revenues on monthly or annually basis such as found in courses, monitoring, magazines subscription and mobile applications. While the transaction ones are the single payments against purchased service or product such as found in exhibitions, seminars, training, emergencies and testing. Changes are applicable based on the frequency of service occurrence.

4.5.1. Expected Revenues per Segment

Expected revenue streams are tabulated in Table 13 and manipulated per each customer segment as follows:

- Academia
  Academic teachers and university staff can benefit from seminars and exhibitions while researchers and high degree students can join NTC courses and trainings.

- Healthcare professionals

  Physicians, nurses and other healthcare professionals are being offered to join seminars and exhibitions. They can facilitate monitoring and emergencies, benefit from newsletters or magazines, and participate in mobile applications and trainings.

- Enterprises

  Corporates and healthcare startups can participate in exhibitions or seminars, utilize NTC facilities in their product development, testing and evaluation, and market their services in NTC magazine issues.

- Municipalities

  NTC can facilitate virtual network as a connection in case of emergencies and offer this service for municipal healthcare programs.

- Civil society

  Common people and patients can benefit from NTC courses and trainings to use devices or gain eHealth knowledge, purchase newsletters or magazines, subscribe in mobile applications, benefit from monitoring devices and use NTC virtual network to connect with doctors.

  Expected revenue streams are tabulated in Table 13.

Customer segment	Expected revenue stream via
Academia	Seminars
	Courses
	Exhibitions
	Training
healthcare professionals	Seminars
	Exhibitions
	Monitoring/Emergencies
	Newsletters/Magazines
	mobile Applications
	Trainings
Enterprises	Exhibitions
	Testing
	Seminars
	Monitoring/Emergencies
	Newsletters/Magazines
Municipalities	Monitoring/Emergencies
Civil society	Courses
	Newsletters/Magazines
	Monitoring/Emergencies
	mobile Applications

Table 13. Expected revenue streams per customer segment.

4.6. Key Resources

Resources are the assets and infrastructures that are required to run the business model. Key resources facilitate NTC values creation and delivery to the beneficiary customer segments. Three types of resources are available in NTC: physical resources, intellectual resources and human resources. They are presented in Table 14.

Type of resources	Example
Physical	Premises
	Showrooms
	Basic equipment
	Communication devices
Intellectual	Virtual network
	Video conferencing equipment
	Smart monitoring devices
	Medical wearables
	mobile applications
Human	Healthcare staff
	IT technical staff
	Administration staff
	Logistics staff

Table 14. NTC key resources classification.

4.6.1. Physical Resources

NTC three physical nodes are located in both partner countries, Seinäjoki (Finland) and Umeå (Sweden). There is also a physical entity in Vaasa, which is closely connected to academic research and teaching activities in the University of Vaasa. The center in Seinäjoki and showroom are located in Mediwest building and operated by EPTEK as shown in Figure 19. Two physical nodes lie in Umeå, one is found in and operated by the University of Umeå and the other one is located in Umeå University Hospital and operated by VLL as shown in Figure 20.

Figure 19. Seinäjoki showroom in Mediwest, EPTEK facility.
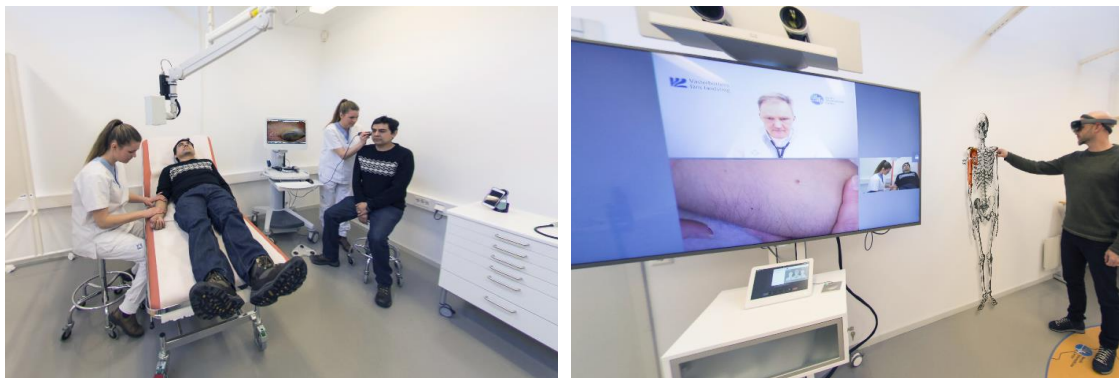
Figure 20. Showroom in Umeå University Hospital.

Each node contains a showroom for exhibiting and testing the telemedicine technology. Premises include the basic facility requirements such as PCs, scanners, printers, office rooms, meeting rooms, Tables, chairs and desks. Servers and other basic communication devices are also examples of NTC physical resources.

4.6.2.   Intellectual Resources

The showrooms are mainly the place which contain most of the intellectual part of NTC resources. Seinäjoki showroom exhibits varieties of smart homecare devices that are capable of user monitoring and measurement of vital signals regularly. It contains the following facilities:

- Bed Monitoring System

The smart bed located in Seinäjoki showroom is consisted of soft comfortable mattress embedded with monitoring sensors such as motion sensors and counters from EMFIT Company. These sensors are used to get clear data about the person's sleep quality and sleep times to early diagnose sleep ulcers and other types of disorders. The bed monitoring system is presented in Figure 21.

Figure 21. Bed monitoring system at Seinäjoki physical node. (NTC 2017)

- GPS tracking systems

GPS devices are used to secure user's movement and to operate as a wireless safety phone for patients with memory disorder when necessary. The GPS module in the device allows the user to move freely inside a preset area previously inputted to the device. Any crossings or movement outside that area triggers an automatic alarm along with sending a message including the exact location of the user to the alarm recipients. A couple of such GPS devices by different manufacturers are shown in Figure 22.

Figure 22. Various GPS tracking devices in Seinäjoki showroom. (NTC 2017)

GPS tracking devices information can be followed via Internet or by using a smart phone application. The user has the ability to send an alert by pressing a button in case of emergencies. The GPS device should be recharged on daily basis since the GPS module consumes most of the battery.

- Digital key management

Figure 23 presents a digital door lock which can be opened using a smartphone application besides the default key lock lever.

Figure 23. Digital door locks in Seinäjoki showroom. (NTC 2017)

The digital door lock can be installed upon most of the common lock models and without the need to make holes in the doors. It can be used in home care services so that the nurse does not need to carry keys for all customers.

- Safety phones and base stations

A security phone can be used to seek help in case of emergencies by pressing the red alarm button in the device which can be attached to the user's wrist or neck. Different security phones are presented in Figure 24.

Figure 24. Various safety phones (base stations) in Seinäjoki showroom. (NTC 2017)

By pressing the button, the user can open conversation with the contact person through the device to get help. Numerous types of accessories can be interfaced with the safety phones, such as: door, fire and fall alarms depending on the manufacturer.

- Door alarm systems

For patients with memory disorder, door alarm devices provide ease and security to the patient and his close ones, since the door alarm notifies the others if the patient is leaving the room. Different door alarm systems at Seinäjoki showroom are presented in Figure 25.

Figure 25. Various door alarm devices in Nordic telemedicine Center, Seinäjoki. (NTC 2017)

Depending on the manufacturer, the alarm function can be triggered upon one of the following events:

- The door has been opened
- The door was left open for a while
- The person has left out of the room or entered the room through the door

There are two types of alerts: local alerts and external alerts. Local alert occurs when the door alarm unit is placed within the same building with a beep, tone or pilot light that is triggered by opening the door. External alert occurs when the alarm triggered by opening the door is transferred via safety phone call, text message or smart phone application to the alarm center. For enabling medical staff in and out, the alarm can be configured to use a bypass function to use the door without alerts. The recent advanced version is the smart door alarm device that can recognize the timestamp when the patient leaves the room. The device in return alerts the alarm center by placing a safety phone call to the contact person in the alarm center. A time-delay can be set for the alarm to enable the patient to leave for a certain period of time to collect mail or peeking out of the door. The

latter is one of the known symptoms of memory disorder and may cause the smart door alarm to make false alarms.

- Daily life devices

The main theme of the Seinäjoki showroom is about assisted living. Seinäjoki showroom contains necessary daily life devices to facilitate the person's activities all the time. Coffeemaker, water kettle, digital calendars, pill dispensers, smart touch Tablet and music player are types of such devices that are present in the center as shown in Figure 26.

Figure 26. Daily life devices in Seinäjoki physical node. (NTC 2017)

- Memoera trainer

Memoera trainer is developed to deliver entertainment and activity for patients with memory disorder. Memoera is shown in Figure 24.

Figure 27. Memoera trainer in Seinäjoki showroom. (NTC 2017)

The device contains different types of games that are able to activate different parts of the brain and several senses at the same time. The device is designed to be easy to use.

- Digital calendar

An automatically updating electronic calendar that displays the date, weekday, time of day and clock as shown in Figure 28. The calendar can be configured to trigger a reminding alarm to any upcoming events or reminders about the daily medication times.

Figure 28. Haltija Calendar in Nordic telemedicine Center, Seinäjoki. (NTC 2017)

The digital calendar is mainly meant for patients with memory disorder. The continuous view of time and date sheds more feeling of security and independency besides facilitates daily routines. The large sized screen of the digital calendar, viewing the time of day using graphical illustration, screen contrast and big letter fonts make it easier to view displayed information distinctly. The calendar can be switched to either Finnish, Swedish or English languages. It has a built-in battery to store previous information during the time of electric blackouts. The digital calendar can be easily installed on Tables or can be hanged on walls easily.

- Pill dispenser

This device is used to remind the person for taking the medicine dosage in its due time. The pills are distributed inside the device then when the time is due to take the dosage, it gives alarm and when pressed on its button, the pill come out of the device to be swallowed by the person as shown in Figure 26.

Figure 29. Pill dispenser device. (Careousel 2017)

- Other devices

Other useful devices are provided in the showroom such as emergency alarm button, key finder and Android based devices dedicated to assisted living information as shown in Figure 30.
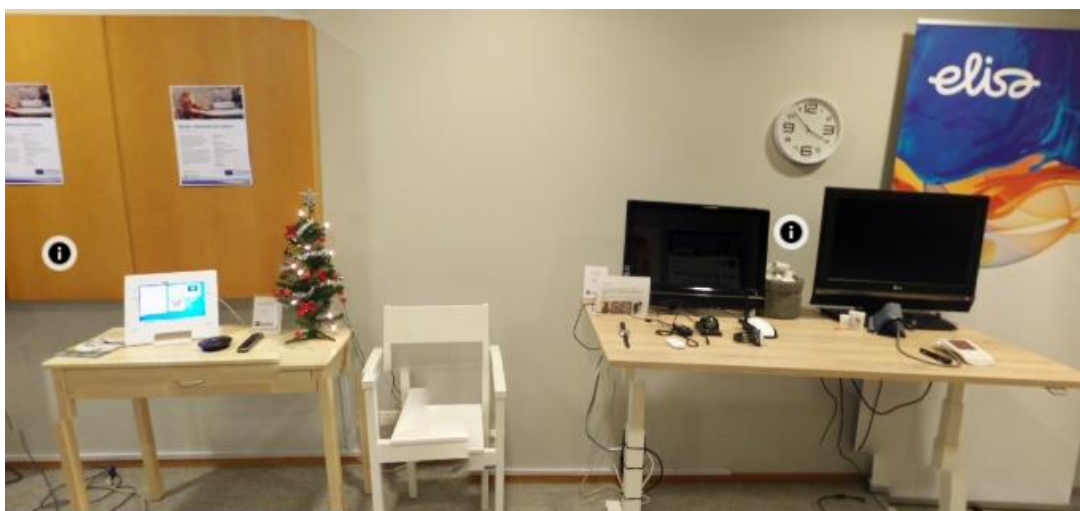
Figure 30. Other devices in Seinäjoki physical node. (NTC 2017)

4.6.3. Human Resources

The operating staff of NTC is expected to be organized similarly as research group in the university. Future organization will be inevitably having slight differences than the current project-wise staff structure. Extra positions shall be added, and some job descriptions are subject to changes to adapt the required tasks. For example, there is a need for the following positions: public relation manager, and one or several healthcare interns or elaborators, dedicated personal assistants and content writers. Nonetheless, all NTC staff can be categorized as healthcare staff, technical staff, administration and logistics staff.

The NTC organizational formation is up to the persons who are in charge of NTC organization. The employees may be directly hired by each NTC partner or hired by the some partners. Another way is to establish a jointly owned organization hiring the employees directly to run NTC center.

Table 15 shows the recommended overall NTC staff positions who would be responsible for running the center.

Type of Human resources	Positions
Healthcare staff	Intern or an elaborator
Technical staff	IT technician
	Webmaster/Software developer
	Content writer
Administration staff	Physical node officer
	Public relations manager
Logistics staff	Dedicated personal assistant
	Customer service agent
	Marketing manager

Table 15. Recommended NTC Human Resources structure.

- Healthcare intern or elaborator

The main responsibility of this position is to elaborate healthcare related issues to guests during demonstrations. Besides, direct the technical staff to fetch new devices that are necessary for healthcare improvements if any. Furthermore, bring a healthcare perspective to the research work and contribute to the publications. It is advised to employ at least one personnel per this position.

- Technical staff

- IT technician

IT technicians are responsible for maintaining NTC devices from an engineering point of view. They must have technical background and practical knowledge. The main tasks for this staff are to perform regular maintenance for the showroom devices, improve virtual network connectivity and calibrate gauge devices from time to time. In addition, IT technicians should consult with the administration and the healthcare personnel in order to furnish latest technological devices if they are found to be a useful improvement to the center. The more the number of technicians the more the service quality is improved, but it is sufficient to have at least one person in this job.

- Webmaster/Software developer

NTC services are presented onsite and online. Hence, there is a demand to have a professional online administration. It is advised to appoint a professional programmer with computer science background as a Webmaster. The main responsibilities for the Webmaster are to maintain NTC website, add the online shop feature and provide a secure web surfing. In addition, a Software Developer can do the same responsibilities with an extra edge which is the ability to develop mobile applications related to the center's scope. Later they can be presented as a standalone NTC service. Software Developer is also responsible for maintaining and developing the virtual telemedicine network. It is advised to have both roles separately when the workload escalates though in the earliest stages of operation it is recommended to have one employee that can carry out both responsibilities.

- Content writers

NTC business model includes issuing necessary publications for the corresponding customer segments. There are contents that are shown to customers either online or offline which require appointing writing tasks for professional writers. This taskforce will be responsible for rendering all written tasks related to NTC documents besides maintain the web portal content as well. The successful content writer should be able to use the suitable writing language style for each customer segment and to develop extra blended style that can match numerous segments or the public. In addition, online content writer should specifically possess search engine optimization (SEO) writing skills hence the website can more easily found by users who are in search of the same scope. One more responsibility for the writer is to prepare, revise or issue all the rendered agendas, meeting results or plans i.e. take care of internal documentations. At least one person is required for this role.

- Administration staff

Administration staff is NTC front runners and the main responsible for its operation.

- Physical node officer

Physical node officer is the head of administration within the corresponding physical node. Main responsibilities of the officer are to manage the operations in the node, generate and follow-up with tasks, cooperate with other NTC physical nodes and to sign

the paper work of the node. The officer should be the main responsible for all the work duty in that particular NTC physical node. Besides, the officer should adhere to the set business model and conform all means for the successful implementation of the model. The successful candidate for this role must have sufficient academic qualification and experience about similar managing duties.

- Public relations manager

NTC business model require brokering deals with potential partners and communication with higher managerial level of officials and customer segments. A public relations manager is supposed to perform these essential duties. Negotiation and communication skills are essential in the public relations manager task. These requirements are needed to facilitate the PR mission and make it much easier. Besides, the PR manager shares administration responsibility with the officer. They together form the administration staff whereas important decision and future plan should be set and discussed in between.

- Logistics staff

Logistics staff is responsible for maintaining the touchpoints between NTC and its customers.

- Customer service agent

Customer service agent has a direct touchpoint with NTC customers. The main responsibilities include answering to customer inquiries via email or phone and maintaining an enduring Customer Relationship. Customer service agent should have the capabilities of dealing with various types of customers to successfully communicate the required message. In addition, customer service agent should be in charge of the onsite info desks.

- Dedicated personal assistant

As discussed in section 4.1, there is a demand for a dedicated contact person for some types of customer segments. This is a type of customer care role nevertheless with a special role of regular contact with the given customer segments. It targets to maintain an informative relationship. The successful candidate should possess customer service skills and formal skills of communication.

- Marketing manager

Reaching out to customers using the proper means and the suitable style are two essential tools for spreading knowledge about NTC activities. Hence, the marketing manager will be in charge of designing marketing campaigns online and offline. Customers will not appreciate services and activities unless they have been presented well and in a convincing way. The marketing manager should discuss the working plan and marketing campaigns with the administration, prepare the materials with the rest of the staff and inform them about what they should expect as a campaign result i.e. sales surge, inquiry calls or emails.

4.7. Key Activities

Key activities building block encapsulates all the services, product and activities that NTC is recommended to carry out for creating, offering and delivering value propositions. The annual activity plan should be set up by all NTC staff at the beginning of each year. An action plan can be derived from the overall annual plan to be conducted and converted to tasks for plan execution.

4.7.1. NTC Services

NTC services are the key activities that can be offered by NTC to its customers, which are:
- Seminars
- Exhibitions
- Trainings
- Courses
- Newsletters and Magazines
- Testing
- Remote Monitoring and Emergencies (recommended)
- Mobile Applications (recommended)

• Seminars

Seminars are the occasions whereas a teacher or an expert and a group of interested people meet to study, illustrate and discuss something in common. Seminars can be conducted

regularly to discuss various topics that concerns the telemedicine society and are aligned with NTC scope. NTC personnel can request speakers from academia and enterprises. Seminars not necessarily to be carried out inside NTC premises, but it is preferably. NTC administration should set up a plan per each quarter of the year to state what hot topics are going to be discussed in NTC seminars are and how many seminars are needed to cover all these topics. Seminars as activity should be primarily monetized with reasonable prices for the audience yet some special guests can be offered attendance for free. NTC staff should figure this out.

- Exhibitions

Exhibitions are events in which objects are shown to the public or someone shows a particular skill or quality. NTC physical showrooms have many things to be shown to the public and beneficiary customers. For example, homecare devices, monitoring equipment and wearables. Exhibitions can occur frequently and on-demand. The NTC showroom can be utilized to demonstrate the telemedical solutions that NTC can offer. Some of the exhibitions can be carried out off campus using banners showcasing the same offerings, if applicable. Exhibitions usually come free of charge to the attendees, yet participation fees can be added in situations when applicable. They should remain in reasonable prices.

- Trainings

Training is the process of learning needed skills to do a particular job or activity. Customers who purchased NTC services or devices need trainings to exercise on using the acquired value. Typically training is something which is organized for professionals as a short-term intensive study about some specific topic. While education is something which can consist of one or several courses, for it takes longer time and does not necessarily require prior knowledge about the topic. For instance, customers can receive trainings on how to use homecare devices and how to act at emergencies. The knowhow how to establish a virtual telemedicine session between the center and the other terminal that can be with a Hospital, doctor at clinic or physiotherapists, can also be a topic of training. NTC administration should specify trainees for conducting these trainings along with discussing about the training contents. Participation fees are essential and logical in these services as conducting trainings comes with costs.

- Courses

A course is a set of classes or a plan of study on a particular subject, usually leading to an exam or a qualification. NTC staff should define the courses topics, outlines and syllabus in order to be carried out by the suitable course instructors. Courses can be co-created with regional universities in both partner countries. Instructors can be found from the academic staff or the industrial research and development from partner enterprises. Courses topics should reflect the NTC scope and align with its value propositions, such as the eHealth course conducted at the University of Vaasa during autumn semester in 2016. Courses are highly recommended to be carried out regularly and on annual basis. Monetization of this activity is expected to create a profitable revenue stream.

- Newsletters and Magazines

Newsletters and magazines are the printed or electronic document containing information about the recent activities of an organization, sent regularly to the organization members. NTC news should be regularly publicized as newsletters and sent electronically to customers' mailing lists. It can also be produced as hard copy printed magazines that can be sold to customers who prefer hardcopy over electronic format. It is advised to issue one newsletter or magazine per quarter, which makes a total amount of four issues per year. Monetization can take place in two ways, annual subscription for the electronic version and price payment per hard copy.

- Testing

Testing is the conduction of technical experiments, calibration upon equipment or devices, evaluation of products and assessing the usability of devices. NTC technical support personnel are recommended to carry out this services for the beneficiary customers. Homecare devices which are offered by NTC need to be calibrated regularly to adjust its measurement gauges. Meanwhile, NTC can offer this service as a standalone monetized service for other customer segments such as enterprises.

- Remote Monitoring and Emergencies

In certain cases the patients such as elder people with chronic diseases can be remotely monitored to enable them staying at home and living as normal life as possible. For example, monitoring their movements and vital signals using wearable sensors and NTC

network. There are various types of monitoring devices and sensors that NTC contain in its showrooms. Movement sensors are of various types to monitor possible falls. Measured vital signals provide information about the overall health indication. And recently, NTC is planning to offer drone service to locate missing people and report to the nearest ambulance brigade in cases of emergencies. NTC can also offer solutions to handle other types of emergencies such as urgent birth complication during hospital off-hours.

- Mobile applications

Mobile applications are programs that can be installed on mobile phones and used to facilitate communication with the server. NTC is recommended to issue mobile applications compatible with all mobile operating systems that can hub the users with NTC server to benefit from its services. Among the recommended offerings is an application to connect between the user and the doctor or nurse for a virtual diagnostics or virtual visit. This idea is already implemented in the United States and it is growing popular, such as the doctor-on-demand service. The mobile application which provide a virtual network connection service to the user should be monetized.

4.7.2. NTC Project Activities

Since the initiation of NTC project in 2015, the project has carried out some activities so far which can be further added as permanent NTC activities. These activities are as follows:

- Professional consultant services and on-call support

- Emergency support for birth complication

As a part of consultancy service presented by the NTC center, the specialists at neonatal unit at the University Hospital of Umeå are available for video consultation during the off hours of the regional Hospital in Lycksele in case of urgent complication situations during child birth as shown in Figure 31. A resuscitation table equipped with a high-resolution camera is used to capture high-detailed images of the child besides airing a live streaming via video conference system hence pediatricians and neonatologists in Umeå can communicate with the staff remotely. Using that technology, specialists are able to

assess the child's health status, prescribe treatments and prepare for ICU (Intensive Care Unit) transport, if needed.

Figure 31. Emergency support for birth complication. (NTC 2017)

Currently, the clinic delivers averagely 300 children per year, it is found that nearly 1% of children experience complications which require external support. The neonatal department is currently evaluating the feasibility of video conferencing via Tablet computers during the ICU transports as there are about 160 – 170 transports per year.

- Treatment in and near the home

- Hand rehabilitation

The hand and plastic surgery unit offers home treatment via video conferencing for patients who need rehabilitation after hand or arm surgery and injury. Physiotherapists use video conferencing system or webcam to establish a live conversation with the patients who can use their Tablets, smartphones or own computers as shown in Figure 32. Patients who are unable to use home devices, lack access to the required technology or need assistance, can visit the nearest primary health care facility and use its video conference system. The remote support is offered to selected group of patients among the

long-term rehabilitation patients in West Bothnia and other counties in the unit's operation area.

Figure 32. Hand rehabilitation via video conferencing system. (NTC 2017)

The rehabilitation service started to be a routine practice in 2009 till the present time, nearly 10% of the treated patients at this unit receive part of their rehabilitation remotely. In addition, the unit offers monitoring treatments and provides consultancy support to community Hospitals and health centers. Remote rehabilitation can be offered to all patients despite their place of residence hence help patients to embed their rehabilitation process in their daily activity more easily. This service has mutual benefits for both the patient and the therapist as it saves time, reduces travel costs and allow therapists to carry out more assignments per day.

- Virtual medical appointments

Virtual medical appointments are carried out through video conferencing devices or mobile means of communication.

-   Planned receptions for children with suspected heart conditions

The pediatric cardiology unit at University Hospital of Umeå offers virtual appointments to children with suspected heart conditions at Sunderby and Gällivare Hospitals. This activity started as a pilot in 2014 and was implemented in 2016 as a regular activity. The

diagnosis technical procedure is the same as the addressing of acute heart conditions in children. It is based on cardiac ultrasound signals assessment that can be streamed in the real-time as shown in Figure 33.
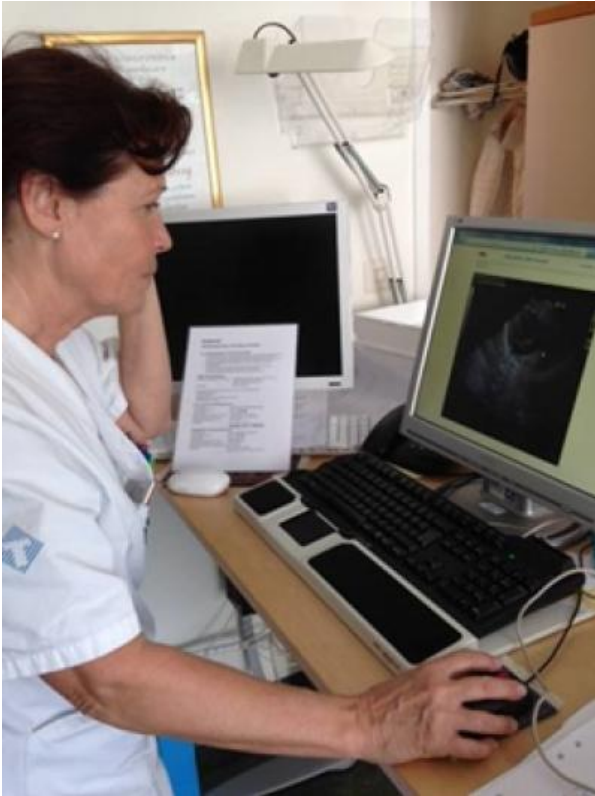
Figure 33. Examining ultrasound images of children with suspected heart conditions via secure web portal. (NTC 2017)

By guiding the pediatricians at the child's home Hospital, the cardiologists at University Hospital of Umeå can provide their consultation for the case based on an ultrasound examination during a regular phone call. The video output of the ultrasound signal device is connected to a streaming server that is linked with the network. The cardiologist at University Hospital of Umeå logs on to a secure web portal to view the ultrasound images in real-time. The examination can be solidified by showing previous recorded ultrasound examinations and comparing to them.

- Networks, teamwork and other virtual support

Network virtual support is done remotely by means of network management devices or programs that facilitate the required support to its beneficiary customers or patients.

- Remote interpretation

The Interpretation Center in West Bothnia is serving people with deafness, blindness and hearing impairment. Writing interpretation is provided since the middle of 1990s whereas the interpreter uses a video conferencing system and the patient observes the interpretation on a computer or video conference system via fixed or mobile network connection as shown in Figure 34.

Figure 34. Remote writing interpretation via webcam. (NTC 2017)

Remote interpretation cane take place during a two-part conversation, for example during a visit to a physician or a phycologist. Also other types of meetings with more than two participants can be utilized. This activity is benefiting both sides: the interpreter saves the travel time and can carry out more assignments. On the other hand, some patients prefer bipolar discussion. The patients will save travel time on roads as well.

- Multi-disciplinary conferences and rounds with remote participation

Such conferences are held regularly to endorse specific trending scientific topics with a remote participation feature.

- Sarcoma round

The University Hospital of Umeå arranges weekly sarcoma rounds for patients from the Northern healthcare region. Nearly 400 patients per year are directed to the orthopedic clinic at University Hospital of Umeå and most of these cases are discussed within the round as shown in Figure 35. Participants are regularly representatives of oncology, pediatric oncology, orthopedics radiology and pathology. Contact nurses and candidates participate occasionally depending on the criteria of cases such as ear, nose and throat problems, hand surgery, vascular surgery or general surgery as well.

Figure 35. Sarcoma round. (NTC 2017)

Hospitals of the Northern healthcare region can connect to the round remotely. The regular sarcoma rounds of pathologists are usually done between a pathologist from his home in Gothenburg and University Hospital of Umeå. The pathologist connects via video using two computers to ensure visualization of information from multiple sources. This way, full participation in the round is guaranteed besides the ability to view histopathological images scanned by pathologists at University Hospital of Umeå and accessed remotely via VPN connection. Pathologists can participate locally from University Hospital of Umeå on a monthly basis.

• Self-measurement and point-of-care testing

Self-measurements of the patient body readings and carrying out tests without requiring any external help.

- Self-measurement in primary care

Traditional monitoring of anticoagulant therapy is based on venous blood sampling which takes certain time to yield the result. As a consequence, it is a time-consuming process for the patient and the staff. A solution is presented by some primary care facilities in West Bothnia by providing for the patient devices to measure blood pressure and coagulation with limited support from the staff. Self-testing alternative relies on a point-of-care device that requires only one blood capillary sample as shown in Figure 36. The test result is directly shown on the device and automatically transferred to the patient's medical record to be assessed for prescription.

Figure 36. Self-measurement device for blood pressure. (NTC 2017)

This way, the processes of sampling and ordination take shorter time, the costs for sample management are reduced, and both the patient and the medical staff time is saved. Since 2016, the West Bothnia County Council is subsidizing point-of-care equipment for specific patient groups for INR (International Normalized Ratio) monitoring at home in addition to laboratory-based monitoring.

• Proof of concepts

Validating the regularity of the patient body movement, well-being and vitality.

- KINESIS: Kinetic smart evaluation for cross-country Skiing, a data-driven automatic assessment of double poling technique

KINESIS is developed to examine the role of biomechanical body variables on energy consumption and speed. It performs double polling (DP) of cross-country skiers using an artificial intelligence approach. KINESIS captures the biomechanical features using a 3D camera. Heat rate and other body information is received via connected sensors to develop a biomechanical profile of the skier. Using two types of machine learning algorithms, poling and recovery phases of the DP. The information presented in Figure 37 are obtained by using the two types. The tool provides real-time feedback whenever the skier's movement coincides with a reference movement.
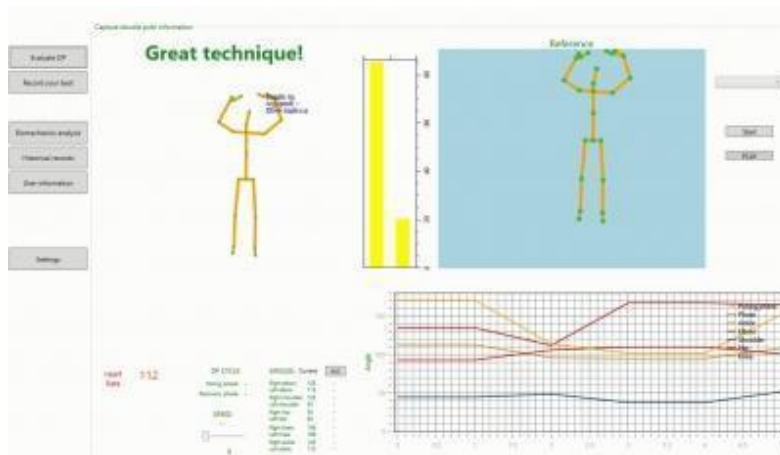
Figure 37. Screenshot of KINESIS evaluation tool. (NTC 2017)

The Umeå Sports Science School supports the development of KINESIS. Currently it is being tested with the cross-country skiing team of Umeå University. The correlation between biomechanical analysis provided by KINESIS and the physiological indicators (oxygen consumption, heart rate, lactate threshold) can be the input to a new line of research for extending the collaboration between researchers in computer science and sports science.

- Balansera

A mobile application for a self-test to assess standing up from a chair. The Balansera application is created to motivate older adults and increase their levels of participation in

exercising. The target audience is people living at home who are willing and able to train their strength and balance. The Short Physical Performance Battery (SPPB) test is an assessment protocol used in Balansera to evaluate strength and balance. The SPPB score depends on timed and observational measures of standing balance, walking and the ability to stand up from a chair as shown in Figure 38.

Figure 38. Balance test using Balansera application. (NTC 2017)

Balansera functions are developed to obtain and test functional leg strength and its balance in addition to sending an automatic feedback to the user. Audible sound and tactile vibration signals are generated as an alarm for any abrupt movements that can be indicator to a possible fall. The optimal reference movements are previously defined by physiotherapy experts who can define limits and references of what an optimal movement should looks alike e.g. rising up fast or sitting down slowly. Balansera compares the actual real-time movement with the reference movement that is already stored in the application.

4.8.   Key Partnerships

Brokering business alliances leverages the business and maximize the value proposition. As stated earlier in Chapter 3, there are four types of partnerships, which are: strategic, coopetition, joint ventures and buyer-supplier. NTC administration should reach out to potential partners, which operate in NTC area of scope, set the terms of partnership and build up a mutual agreement between the two entities.

The current NTC project partners are likely to resume partnerships for further periods. The current NTC partners are: Botnia-Atlantica (Interreg), University of Vaasa, EPTEK,

Umeå University, VLL, City of Vaasa, Elisa, Wapice and The Hospital District of South Ostrobothnia.

The required NTC alliances for adding extra values are recommended to be of the following types:

4.8.1. Strategic Partnerships

Strategic partnership is the alliance found between non-competitors. For NTC to gain more resources and more spread, there should be a continuous search for strategic partners. The motive in this type of partnership is the acquisition of resources whereas NTC will be granted access to more customers, acquire knowledge and licenses. Strategic partnership can take place between NTC form one side and from the other side eHealth institutions, healthcare enterprises, universities, Hospitals and municipalities. The recommended partnerships for the earliest stages of executing the business model are the partnerships between NTC and homecare devices manufacturers, academia, interested healthcare enterprises and municipalities. These partners would help in acquisition of extra resources as well as provide more concept regional spread. Eventually, administrators can reach out to more strategic partnerships such as eHealth institutions and Hospitals for a leap business expansion.

4.8.2. Joint Ventures

Joint ventures is an alliance created between two organizations to develop new business opportunities. NTC is currently operating in two Nordic countries: Finland and Sweden. It is recommended to extend the center to other countries as well, especially the nearby Scandinavian countries in the same territory as Norway and Denmark. That will not only create new business opportunities but also will spread NTC concept to larger area and more beneficiary audience. Two extra physical nodes can be created into the recommended Nordic countries Norway and Denmark, and their virtual nodes can be included in the NTC network. The result of these new alliances would increase the targeted customer groups to at least three times the current business study and that would enhance the ROI more positively. The motives to build this type of partnership are the strengthening of the business model and the acquisition of new resources in this case.

4.8.3. Buyer-Supplier

Buyer-supplier is an established alliance to ensure the constant flow of supplies. NTC suppliers can be the homecare device manufacturers and pharmacies. In this case, the manufacturers can be partnered as Buyer-Supplier partnership on grounds of franchising whereas NTC will act as the middleware between the manufacturer and the customer i.e. a showroom for the manufacturer. But in the previous type of partnership, manufacturers were strategic allies whereas they guarantee the discounted provision of devices for demonstration inside NTC showrooms. So consequently, it is a double beneficial alliance. On the other hand, pharmacies can contribute in the project by supplying the necessary measurement and gauge devices for the human vital signals as well as supply the ergonomic tools whenever required like the medical wrists, knee supports and special disabilities tools. The main motive for this type of partnership is the improvement of the business model as the buyer-supplier alliance would save the smooth operation of NTC activities.

4.9. Cost Structure

NTC as a Nordic Telemedicine Center is supposed to operate as a multi-national center of excellence. In terms of funding it should be as self-sustaining as possible, though there is a high probability that part of the funding should come from the public sources also in the future. The way how the center is going to be organized is still an open question and under investigation: a separate company, public association, institute jointly owned by the participating organizations, company jointly owned by the participating organizations.

4.9.1. Proposed Cost Structure

Staff salary as a large part of the monthly cost structure should be calculated according to the qualifications and the duties of each member of the staff. In Table 16, some acceptable estimates for the salaries based on qualifications are tabulated. Each basic salary is added to a 35% of the basic salary as side costs such as taxation, insurance etc.

Qualification	Basic salary	Total salary after adding 35% side costs
A person not holding a Master's degree	1700 €	2295 €
Master's degree holder	2100 €	2835 €
A person with managerial duties	3200 €	4320 €
Director or PhD holder	3500 €	4725 €

Table 16. Salary estimates based on qualifications.

Consequently, the following salary estimates shown in Table 17 are portraying the maxima and minima of expected salary per each job description. Note that these values are approximated and tabulated per workload percentages.

	Staff position	100% Full time		33.3% Part time	
		min	max	min	max
Technical	IT technician	2 295 €	2 835 €	765 €	945 €
Technical	Webmaster/Software developer	2 295 €	2 835 €	765 €	945 €
Technical	Content writer	2 295 €	2 835 €	765 €	945 €
Admins	Physical node officer	4 320 €	4 725 €	1 440 €	1 575 €
Admins	Public relations manager	2 295 €	4 725 €	765 €	1 575 €
Logistics	Dedicated personal assistant	2 295 €	2 835 €	765 €	945 €
Logistics	Customer service agent	2 295 €	2 835 €	765 €	945 €
Logistics	Marketing manager	2 295 €	4 725 €	765 €	1 575 €
	Total	20 385 €	28 350 €	6 795 €	9 450 €

Table 17. Expected Staff salaries per each NTC node.

Therefore, the total cost structure for the NTC Business Model Canvas including other cost items beside salaries is shown in Table 18.

	Items	Physical node 100% Workload		Physical node 33.3% Workload	
		min	max	min	max
Fixed	Rents for facilities	800 €	1500 €	800 €	1500 €
	Rent for equipment	100 €	200 €	100 €	200 €
	Staff salaries	20 385 €	28 350 €	6795 €	9450 €
Variable	Budget for new devices/services	125 €	150 €	125 €	150 €
	Total (per month)	21 410 €	30 200 €	7 137 €	10 067 €

Table 18. Calculated expected minimum and maximum cost structure per each NTC node versus workloads.

After initiating NTC as a sustainable standalone institution, the workload is recommended to be one third of the duties rather than to be 100%. It is suggested that NTC would be a part of some other organization. Since the NTC is still at starting phase, the expected revenue is expected to be marginal. As a consequence, NTC should keep the cost rate as low as possible. In that case, minimum of 7,137 € euros and maximum of 10,067 € euros are required to cover the costs and execute the Business Model Canvas. Eventually, this percentage i.e. 33.3% of the workload can be further improved proportionally with the increased workload, the degree of spread and success.

Based on the key activities pricing pattern and the amount of purchased services or products monthly, the cost structure can be totally covered from the revenue streams only.

4.10.   SWOT Analysis

SWOT is the acronym for strengths, weaknesses, opportunities and threats in a structured evaluation plan for a business or an organization. SWOT analysis can be prepared for a company, product, place or even a person. (MindTools 2018)

The analysis displays the internal and external factors that are grouped as useful or harmful factors as shown in Figure 39.

Figure 39. The SWOT analysis structure.

The first column states the useful factors while the second column exhibit the harmful factors. On the other hand, the first row portrays the internal issues while the second row highlights the external issues. Hence, planners and decision makers should work towards eliminating the second column i.e. weaknesses and threats besides maximizing the first column factors i.e. strengths and opportunities.

4.10.1. Strengths

Strengths are the internal characteristics of the business or the organization that provide it with advantages over others. The proposed NTC Business Model Canvas possess several strength points that are as follows:

- **Resources and Hierarchy**

NTC has varieties of physical, intellectual and human resources that are well enough to be considered as strength points. The established premises, basic equipment and facilitated showrooms are examples of the physical resources. Virtual telemedicine network, innovative healthcare solutions, smart monitoring devices and mobile applications are kinds of the intellectual resources that NTC possess. In addition, the current and proposed human resources staff and the new recommended organization are two extra strength points that NTC has. The smooth handling via the hierarchy and the specialized staff roles are cooperating to provide efficient work environment.

- **The progress of physical nodes**

Since the initiation of the project in 2015 until Spring 2018, NTC has achieved numerous milestones. Physical nodes were created in Finland and Sweden, virtual network was developed and maintained, tested solutions were presented into showrooms, related courses were designed and lectured, varieties of pilots and events were carried out. Efforts are currently projected towards extending NTC operations to other regions in Scandinavia.

- **Business model speculations**

The conducted pre-investigation study about NTC business opportunities is considered one of the strengths in itself. Recommendations based on Business Model Canvas are found in this Thesis. They portray most of the aspects required for running a sustainability plan for NTC. It is a cornerstone and a core study that can be built upon a larger plan whenever NTC business scope or operative side is extended.

- **Participants and partners**

Professionalism, dedication and reputation of NTC participants and the organizational partners are points of strength. Partners exerted tremendous efforts to meet the milestones in their proper set timings. Besides, the reputation of such organizational partners in both Finland and Sweden adds more momentum to the key partnerships building block of NTC business model. It will also create opportunities to attract more partnerships in the future.

4.10.2. Weaknesses

For NTC to grow good business model, the following Weaknesses are advised to be eliminated:

- **Funding and tight budget**

NTC establishment project was funded by EU Botnia Atlantica. To guarantee a continuation of the center, a sustainable funding is required to allow physical nodes to be leveraged with latest telemedical solutions. Moreover, pilots, conferences and seminars can be conducted on larger scales in the NTC home areas in Finland and Sweden, and also consider the possibility to extend the NTC activities to new Nordic regions.

- **Small-sized human resources**

Limited human resources shed extra restrictions on the innovation, planning and execution. For the NTC sustainability plan to be successful on the long run, sufficient human resources must be guaranteed to ensure running the center properly. Such basic requirements were mentioned in the key resources building part of the business model.

- **Limited spread and few established nodes**

So far, the NTC project is operating within Finland and Sweden only, which is considered as one of the weak points found in NTC as a business and a concept. The Nordic telemedicine center project could be extended to include most of Nordic countries and link them to a huge telemedical network. Besides, the current NTC region already Finland and Sweden. As mentioned in the business model design, it is recommended to extend NTC operation also to Norway and Denmark. NTC administrators are advised to sketch a plan to include both countries in the NTC network in the near future. Establishing extra physical nodes is one successful factor to maximize the project momentum and spread.

- **Current fixed costs**

The existing fixed costs of NTC are relatively high in numbers compared to the available funding resources. In the business model study shown within this document, a compromise between maximizing human resources and lowering the costs was attempted. For future sustainability plan, the solution to this point is either providing more budget from public investors and the increased turnover, or reducing the fixed costs' items.

4.10.3. Opportunities

NTC opportunities are as follows:

- **Society needs and demands**

The growing demand for new and innovative solutions to receive healthcare and reduce healthcare costs is continuously increasing within worldwide societies, especially in Nordic countries. NTC as a concept when implemented should leverage the overall throughput of healthcare delivery. In can also support disease prevention.

- **EU and governmental moves towards eHealth**

One major opportunity found externally is the existence of serious progressive steps towards enhancing eHealth in Nordic countries taken by both the EU and the Nordic governments. Such tendency creates opportunities for by funding NTC-like projects hence more innovative telemedical solutions can be generated. In addition, governments can educate their inhabitants about eHealth concept to eradicate their illiteracy about modern healthcare technologies. This will enable a wider adoption of the technologies utilized in NTC and similar organizations.

- **NTC reputation and established network of contacts**

Already during the center establishment phase, NTC has gained a fine external reputation and numerous organizational contacts among its operation region. These points can be used to leverage NTC business model in various aspects, especially to maximize resource acquisition through partners and stakeholders.

- **Likelihood of project extension in other Nordic countries**

As stated frequently, Nordic countries are the readiest countries to acquire NTC technologies, which is considered a good opportunity for NTC. NTC internal reports showed that the likelihood of extending NTC operations to Norway has increased recently after the conduction of series of pilots and seminars.

4.10.4. Threats

The following points are shedding threats to the NTC business model, as follows:

- **Modernity of the concept and people's trust in eHealth**

Telemedicine in itself is a modern term and a recent technology that may not be found reliable by certain age groups when it comes to healthcare such as elderly people, who are one of the main target groups of NTC. In addition, other target groups may not have learnt about eHealth and telemedicine technologies yet. In contrast, even if people were knowledgeable enough about the concept, that does not guarantee acquiring their trust in

the beforehand technology easily. Enhancing people's trust in telemedicine systems by all possible means shall help in eliminating this point as an external threat.

- **Restricted governmental policies and regulations**

NTC as a concept is mainly based on innovation. The staff is always seeking genuine and innovative solutions to enhance the quality of service presented to the beneficiary customers. Some of the planned solutions may intercept with local governmental policies and regulations such as the usage of drones to find people or patients who are missing. Building up common agreements or notes of understandings between governments and NTC can help minimizing the threat caused by policies or regulations whenever found. Solutions to the threats can be maneuvered one more time to avoid the violation of policies and regulations on worst cases.

- **Failure to extend operations to other countries**

If NTC fails to extend to other Nordic countries, the failure is expected to be caused by external reasons. For example, due to receiving collaboration rejection from organizations found in the targeted countries. That threat shall not be internally because the NTC plan already includes extending operations to the nearby regions. This failure - if happened- will not literally downgrade NTC as a sustainable project though it will confine NTC within certain limits and prevent its maximization in future plans.

A summary for all discussed SWOT analysis points is shown in Table 19.

	Helpful	Harmful
Internal	 - Resources and Hierarchy. - The progress of physical nodes. - Business model speculations. - Project participants and partners. 　　　　　　　　　　S	 - Funding and tight budget. - Small-sized human resources. - Limited spread and few established nodes. - Current fixed costs. 　　　　　　　　　　W
External	 - Society needs and demands. - EU/governmental moves toward eHealth. - NTC reputation. - Established network of contacts. - Likelihood of project extension to other countries. 　　　　　　　　　　O	 - Modernity of the concept. - People's trust in eHealth. - Restricted policies and regulations. - Failure to extend operations to other Nordic countries. 　　　　　　　　　　T

Table 19. SWOT analysis summary for NTC business model.

5. MONTE CARLO SIMULATION

5.1. Definition

Monte Carlo simulation is a computerized mathematical method developed to obtain numerical statistical insights from repeated random experiments based on either real or assumed probability values. This technique is widely adopted by professionals in various fields to help in decision-making based on the risk analysis performed through the simulation.

Monte Carlo simulation provides the decision makers a range of possible outcomes for best-case and worst-case scenarios based on the input conditions. Hence, the output information precision and accuracy increase depending on the degree of reality in the input data.

5.2. Methodology

The simulation idea is adapting randomness to extract meaningful information that can be deterministic in principle. Monte Carlo simulation deals with conditional probabilities that contain dependent or independent events.

Depending on the number of uncertainties and their ranges, a Monte Carlo simulation can include thousands of experiment calculations before it returns the result. Monte Carlo simulation can contain variables of different values and probability distributions such as uniform, normal and lognormal distributions for more accurate results. (Elmusrati 2018)

When conducting a Monte Carlo simulation, input values are sampled randomly from the input probability distributions. Each set of samples is called an iteration; then the result of each iteration is recorded in array and the next iteration is executed to record its outcome and so on. Thus, at the end of the simulation, Monte Carlo algorithm has done thousands of iterations and recorded each iteration result to obtain a rounded probability distribution. (Elmusrati 2018)

5.3. Advantages

The previous Monte Carlo mechanism provides a comprehensive view of "what may happen if?" questions. Furthermore, Monte Carlo is a good analysis method for this purpose, since it provides:

- Probabilistic results not only show what may happen but also how likely each outcome may occur.
- Graphical results can be easily sketched based on their chances of occurrence.
- Sensitivity analysis in Monte Carlo is more efficient as it becomes easier to check which input has the most effect on bottom-line results.
- Scenario analysis is abundant in Monte Carlo as analysts can test specific scenarios and record the expected outcomes.
- Correlation of inputs: Monte Carlo facilitates modelling interdependent relationships between input variables.
  (Elmusrati 2018)

5.4. Approach to Obtain NTC Business Model Insights

NTC Business Model Canvas possess several uncertain quantities, which reside within its building blocks. Some of these quantities are tangible such as the available resources and the size of each customer segment. Others are non-tangible such as customer relationships and customer satisfaction.

For the Monte Carlo findings to be more realistic, input values should be based on real measurements. Otherwise the outcomes will be lacking accuracy. In situations of missing real data inputs, the next best option is to assume input values as close as possible to reality. In fact, NTC business model is one of these situations, which contain both real measurements and other non-real data. As a consequence, the missing data shall be assumed accordingly. Nonetheless, the assumed input data is evaluated in alignment with the designed business model. Therefore, the outcomes shall display certain degree of practical insights to the collected information.

The assumed input data is expressed in terms of value ranges with minimum and maximum boundaries to confine the outcomes within certain reliable limits while the real statistics are expressed in their original form unchanged. This method is expected to

minimize the degree of errors in the displayed result after conducting Monte Carlo simulation. Thus, it can be considered as a catalyzing factor in decision-making process.

5.5. Simulation Code Flowchart

The conducted simulation is written using MATLAB software m-language. The NTC Monte Carlo simulation code is designed based on the following code flowchart as illustrated in Figure 40.
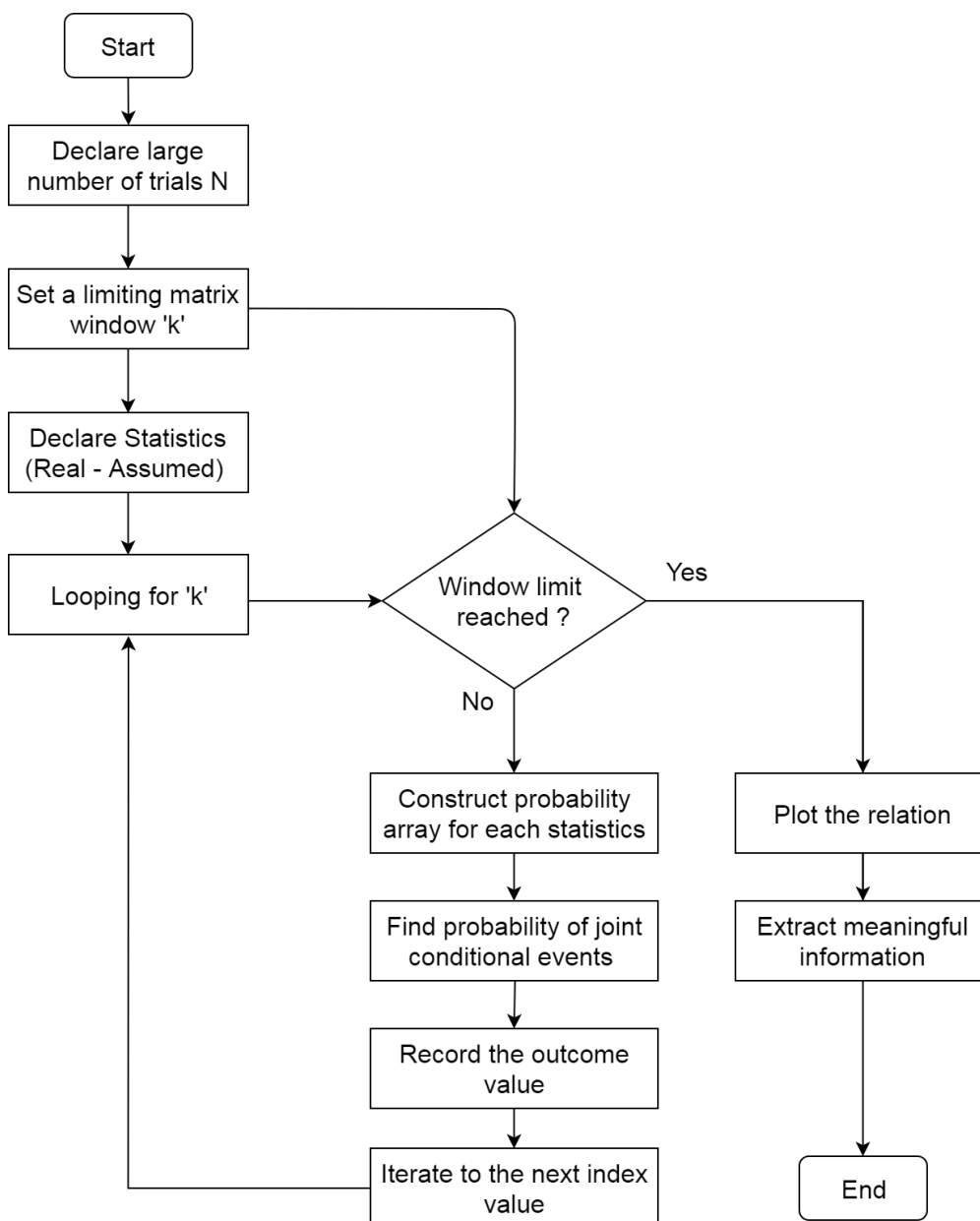

Figure 40. Monte Carlo simulation flowchart.

The design methodology of the code is based on three factors which are large number of conducted experiments 'N', the matrix window 'k' and the real or assumed input data. Increasing the number of experiments ensures precise outcomes i.e. maximizing the k-parameter results in fine tuning of the output towards an exact values. While setting a specific range of values i.e. 'matrix window' provides higher degree of reliable results i.e. more close to reality. In other words, increasing k-parameter results in more precision while providing a window of value range ensure accuracy.

5.6.   Simulation Input Data

As mentioned in the section 5.5, the used input data is either real statistics or assumed ones. Both data types and their corresponding values are displayed in Table 20.

No.	Input argument	value range	Data type
1	Size of academia customers	0 – 4%	Real statistics
2	Prospective academia customers	0 – 45%	Assumed
3	Customers interested in Seminars	0 – 55%	Assumed
4	Customers interested in Exhibitions	0 – 30%	Assumed
5	Customers interested in Courses	0 – 25%	Assumed
6	NTC current workload	0 – 45%	Real statistics
7	NTC to gain popularity in Finland	0 – 65%	Assumed
8	NTC to gain popularity in Sweden	0 – 75%	Assumed
9	NTC operation to be in Norway	0 – 80%	Assumed
10	Elderly people to get lost	0 – 3%	Real statistics
11	Infants to require emergency	0 – 1%	Real statistics
12	Applying NTC drone service	0 – 80%	Assumed
13	Demand for tracking elderly people	0 – 60%	Assumed
14	NTC to provide infant emergency unit	0 – 75%	Assumed
15	Prices (Sale value)	1 € – 1000 €	Assumed
16	Number of leads required / month	1 – 100	Assumed
17	Desired revenues to cover NTC costs	7137 € - 30200 €	Real statistics

Table 20. Real and assumed statistics required for performing the simulation.

5.7.   MATLAB Code Template

The following MATLAB code shown in Table 21 is the main template for conducting all Monte Carlo scenarios performed in this simulation. In total, there are four MATLAB m-files written to conduct the simulation, which all are developed from the same code structure and same flowchart by just changing formulas, parameters and values.

```matlab
clear all
N=100000; %Number of experiment trials
elements=100; %Matrix window elements
Academia=0:45; %Prospective academia are up to 45%

%the step value is in the middle
Academia_new=(0:(max(Academia)-min(Academia))/(elements-
1):max(Academia))/100;

C1_Academia=0:4; %real percentage from statistics
%Academia-to-population
C1_AcademiaNew=(0:(max(C1_Academia)-min(C1_Academia))/(elements-
1):max(C1_Academia))/100;

Seminars=0:55; %assumed percentage
%probability array of interested academia in seminars
SeminarsNew=(0:(max(Seminars)-min(Seminars))/(elements-
1):max(Seminars))/100;

Exhibitions=0:30; %assumed percentage
%probability array of interested academia in exhibitions
ExhibitionsNew=(0:(max(Exhibitions)-min(Exhibitions))/(elements-
1):max(Exhibitions))/100;

Courses=0:25; %assumed percentage
%probability array of interested academia in courses
CoursesNew=(0:(max(Courses)-min(Courses))/(elements-
1):max(Courses))/100;

for k=1:elements
%probability arrays
prosAcademia =(sign(Academia_new(k) - rand(N,1))+1)/2;
All_Academia=(sign(C1_AcademiaNew(k)- rand(N,1))+1)/2;
interestSeminars=(sign(SeminarsNew(k) - rand(N,1))+1)/2;
interestExhibitions=(sign(ExhibitionsNew(k) - rand(N,1))+1)/2;
interestCourses=(sign(CoursesNew(k) - rand(N,1))+1)/2;
%concatenation of all parameters
L=[All_Academia    prosAcademia    interestSeminars    interestExhibitions
interestCourses];
M=[prosAcademia interestSeminars interestExhibitions interestCourses];
```

```matlab
Pa(k)=length(find(sum(L,2)==5 | sum(L,2)==4))/N; % academia & Prospective
& interested in All
Pb(k)=length(find(L(:,2)==1 & L(:,3)==1 & L(:,4)==1 & L(:,5)==1))/N;
%probability that prospective academia are interested in 3 the services
Pd(k)=length(find(sum(M,2)==3 & M(:,1)==0))/N; %non-prospective academia
& interested in services
Pi(k)=length(find((sum(M,2)==3)    |    M(:,3)==1    |    M(:,4)==1))/N;
%prospective interested in seminar and exhibitions/courses
end

Figure;
plot(Pa.*100)
title('All academia Customers growing interest in NTC services')
xlabel('Degree of input data fidelity in %')
ylabel('Joint-interest towards NTC services in %')

Figure;
plot(Academia_new.*100 ,Pb.*100)
title('Prospective academia Customers interest in Seminars, Exhibitions
and Courses')
xlabel('Percentage of prospective academia customers in %')
ylabel('Joint-interest in more than one service in %')

Figure;
plot(Pd.*100)
title('Non-prospective academia customers interest in NTC services')
xlabel('Degree of input data fidelity in %')
ylabel('Joint-interest to NTC services in %')
```

Table 21. Monte Carlo MATLAB main code template

5.8. Findings

5.8.1. Customers' Interest in NTC Services

In this scenario, academia customer segment is taken as an example versus the corresponding value propositions and activities. The interest of academia is expressed in percentage in each key activity such as seminars, courses and exhibitions. Then eventually the joint-interest likelihood is measured, and the percentage of prospective customer is counted as shown in Figure 41.
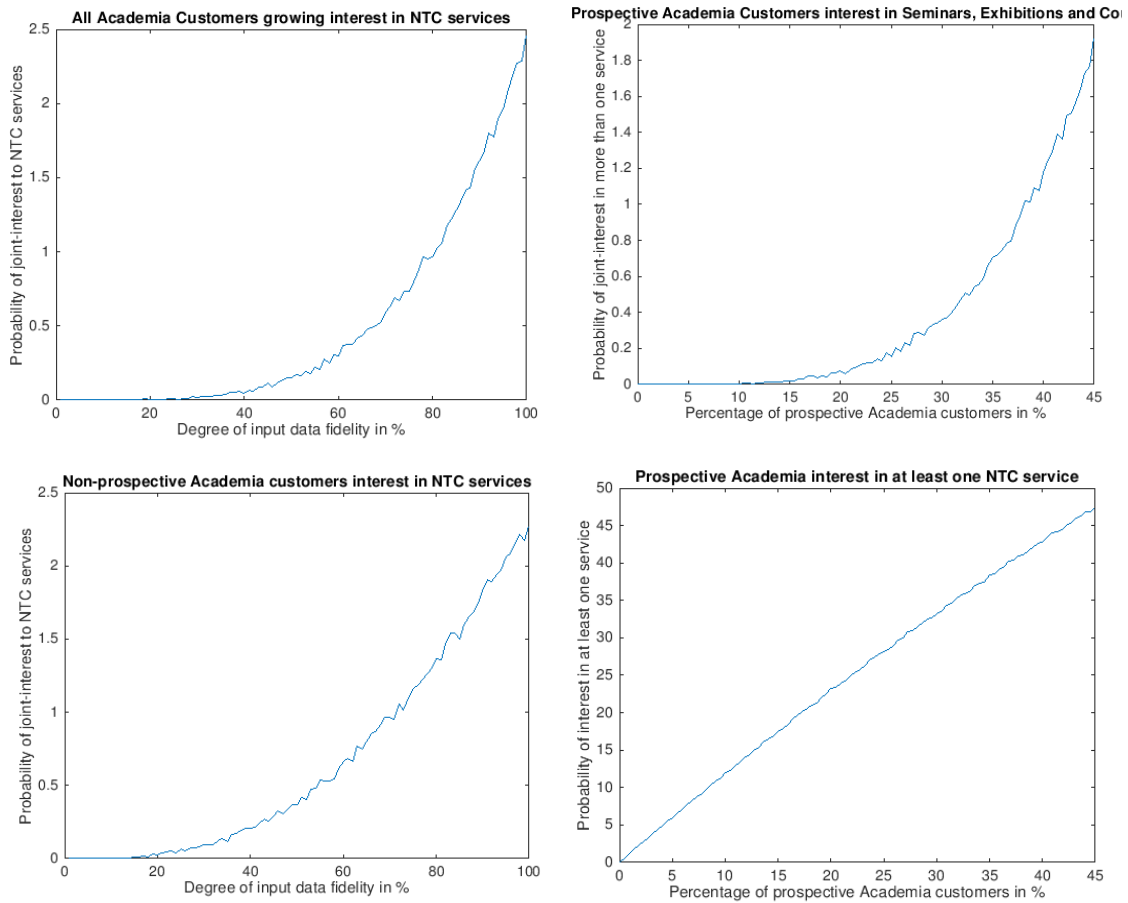
Figure 41. Academia customers interest in NTC services.

Comments

- The upper left plot in Figure 41 describes the relation between the likelihood of all academia customers to be interested in all corresponding offered NTC services and the input statistics degree of fidelity on a scale of 0 – 100%. As the degree of fidelity increases i.e. the input statistics tend to be more realistic, customers interest is increasing. If an imagery tangent line is drawn to the given curve, then a degree of fidelity around 60% can convert the curve to be linear (straight line) from the origin point. This type of quadratic curve relation is abundant in all scenarios of simulating customer type versus services subscription or interest. It can be the case of other segments and services as well.

- The upper right plot in Figure 41 displays the relation between the prospective customers (not all) of the academia customer segment (also known as leads) versus the customers interest in more than one NTC service (not necessarily all services).

The imagery tangent line to this quadratic relation touches the x-axis in between 20 – 25% thus; at least ¼ of the given customer segment is considered leads (should be targeted and retained) to develop a non-decreasing interest in the offered services.

- The lower left plot in Figure 41 concludes that if the used input data is true by 33% accuracy, then non-prospective customers i.e. non-Leads can still grow an interest in the offered services.

- The lower right plot in Figure 41 is confirming that whenever the percentage of leads increases, the customers interest in at least one NTC service increases linearly, that was already expected.

As mentioned above, the same quadratic type of relation is a common graph whenever dealing with any customer segment versus the interest or subscription in NTC services. Graphs in Figure 42 display the likelihood of adding a drone tracking service to rescue elderly lost people and adding an emergency unit for childbirth complication.
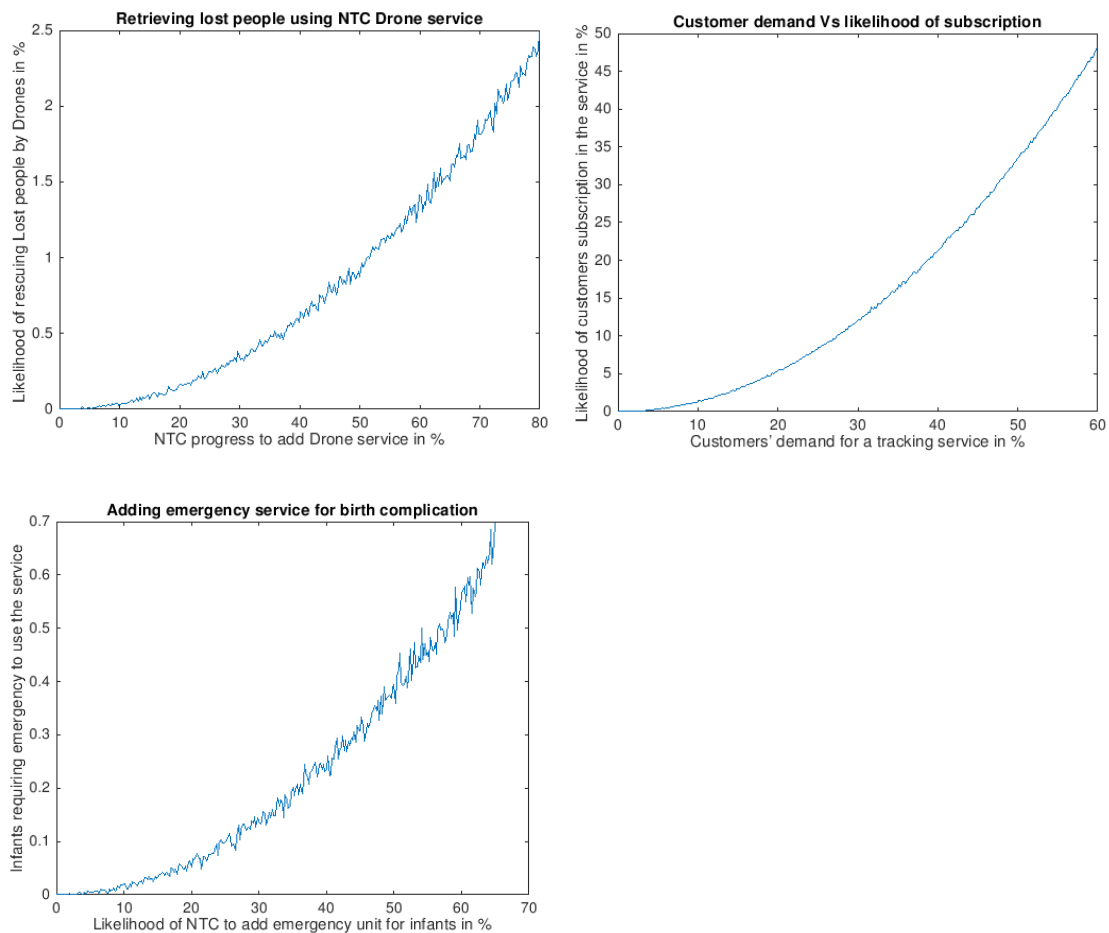

Figure 42. Feasibility study for adding drone rescuing service for elderly lost people and emergency unit for childbirth complication.

Comments

-   For the three graphs, it is clear that the likelihood increases and tends to be linear while the x-axis percentage is around 20%. In other words, the added drone service feasibility to rescue elderly lost people, infants who experience childbirth complications and the percentage of demanding customers for both services shall increase exponentially whenever a minimum of 20% progress is exerted towards solving these problems.

5.8.2.   Extending NTC Operation to Other Nordic Countries

In this scenario, a simulation is conducted to study the likelihood of extending NTC operation to Norway based on assumed input data as shown in Figure 43.
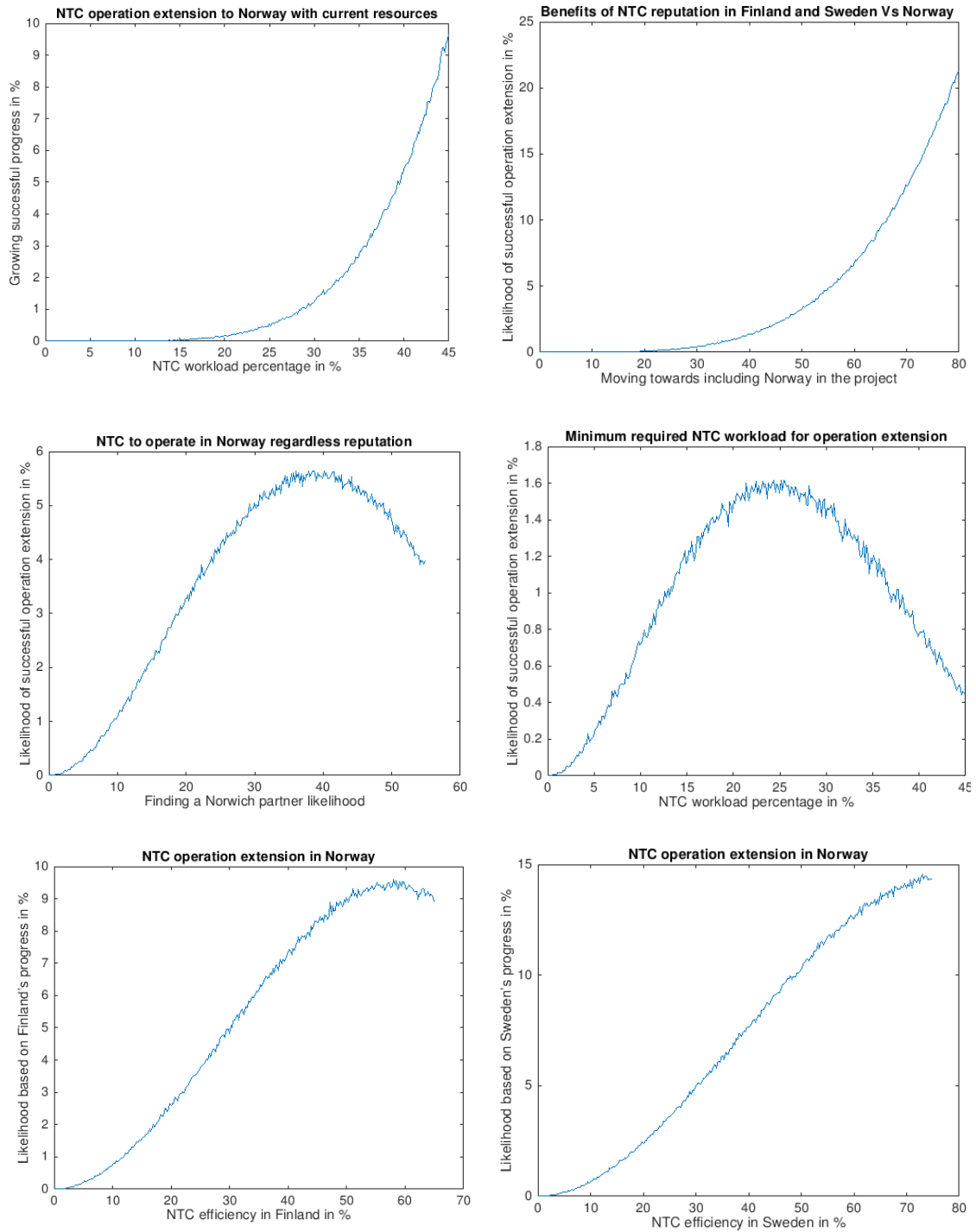
Figure 43. Likelihood of NTC operation extension to Norway versus workload.

Comments

- In the upper left plot of Figure 43, the more NTC workload is applied, the more successful progress in operation extension is achieved, and that was surely expected.

However, the minimum NTC workload needed to ensure this result is a value between 25 – 30% of the full workload.

- The upper right plot of Figure 43 confirms that the NTC reputation developed in Finland and Sweden is one strength point as described in the SWOT analysis, as there is an increase in the likelihood of successful extension whenever the reputation is well.

- The middle left plot of Figure 43 measures the contrary i.e. excluding the reputation of NTC progress achieved so far in Finland and Sweden. The graph shows that the maximum likelihood of finding a Norwich partner to cooperate with NTC in the operation extension process regardless the reputation is around 40% likelihood. The result confirms the mentioned points in the weaknesses and threats sections in the SWOT analysis about either limited spread in Finland and Sweden or the failure to extend operation to Norway are considered harmful.

- The middle right plot of Figure 43 confirms the same result found in the first graph. It indicates that a minimum of 25 – 30% of the full workload is needed to successfully include Norway in the NTC project. Beyond the peak of the curve i.e. 25 – 30%, the curve starts to experience a decrease because the progress achieved in Finland and Sweden is not included in this relation. Thus, no matter the workload increases beyond the peak does not guarantee a successful operation extension to Norway without a proper reputation or accomplishments in the current partner countries. These results confirm the same points discussed in SWOT analysis.

- The lower left and lower right plots of Figure 43 are approximately the same. They deduce that the likelihood of successful operation extension to Norway based on each partner country's independent achievements is still promising.

5.8.3. Covering NTC Costs

In this scenario, real financial formulas described in Equations 1, 2 and 3 are used to speculate some insights among assumed value ranges for unit prices and required number of leads per month besides real calculated values for the desired revenue to cover NTC costs, as shown in Figure 44.

The used financial formulas are as follows:

$$Conversion\ Rate = \frac{Number\ of\ sales\ per\ month}{Number\ of\ Leads\ per\ month} \times 100 \qquad (1)$$

$$Lead\ Value = \frac{Value\ of\ sale\ (price)}{Number\ of\ Leads} \qquad (2)$$

$$Number\ of\ Conversions\ needed\ per\ month = \frac{Desired\ revenue\ per\ month}{Lead\ Value} \qquad (3)$$
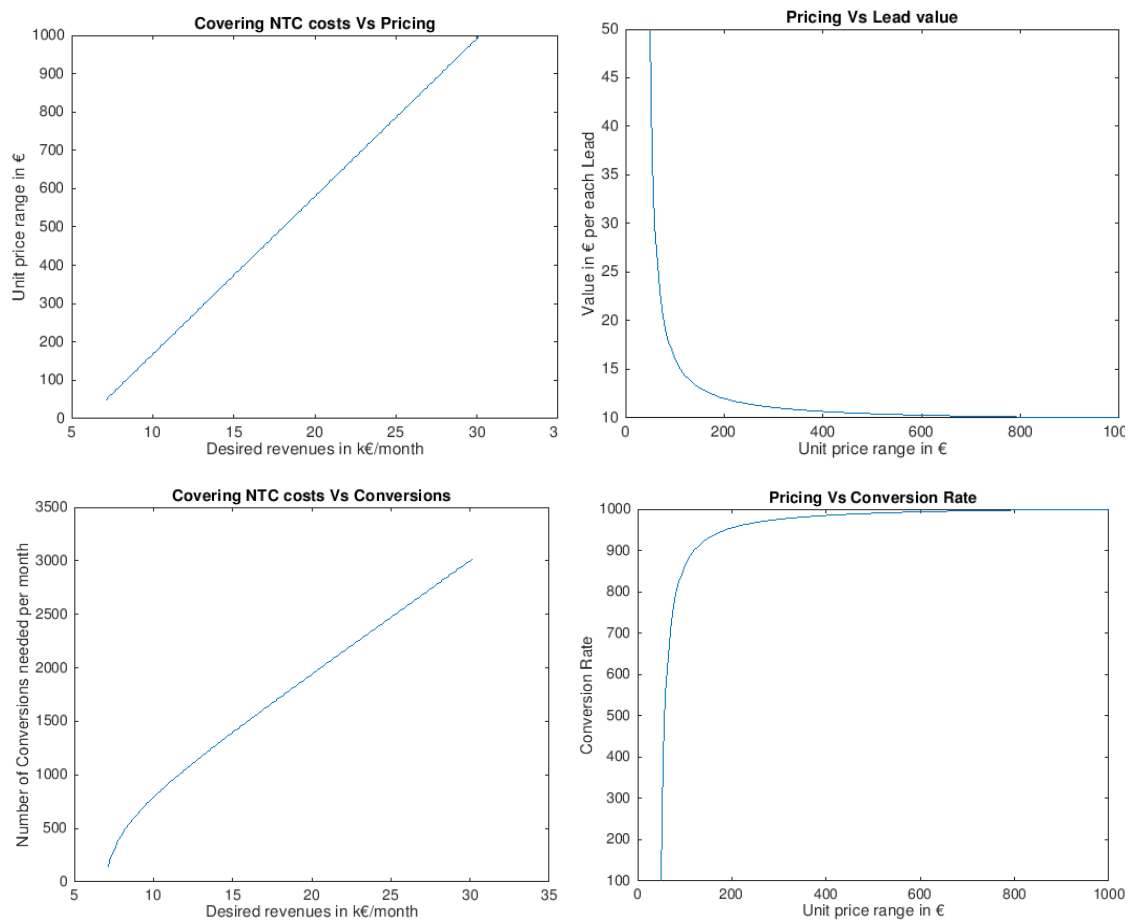

Figure 44. Covering NTC costs versus price ranges and amount of leads required.

Comments

- The upper left and the lower left plots in Figure 44 represent expected linear relations to maximize the desired revenue in thousands of euros. It is obvious that the achieved monthly revenue increases proportionally with increasing either the price range or the number of conversions i.e. converting a lead to a sale. However, there should be a

constraint on the pricing criteria to ensure affordable prices for various customer segments, which will be discussed in the upper right and the lower right plots.

- The upper right plot in Figure 44 shows the relation between the price in euros and each lead's value i.e. amount of revenue generated per lead per sale. Although the lead's value should be directly proportional to the price as described in Equation 2, the graph shows an inversely proportional relation due to using variable number of leads expressed in range rather than a constant number. Hence, in this particular relation, the lowest price returns the maximum lead's value and vice versa.

- The lower right plot in Figure 44 shows the relation between unit price in euros and the corresponding conversion rate. This relation was quite expected, as the conversion rates are maximum during lower prices until they reach a certain saturation point around a certain price range depending on the input data.

6. CONCLUSIONS AND FUTURE WORK

The Business Model Canvas is a very powerful tool that helps in establishing the preliminary business plan for NTC. The deduced Business Model Canvas encapsulates every business aspect in nine types of building blocks that are sufficient to construct a business. NTC value propositions are centralized around improving healthcare and welfare of the civil society in the targeted research region. The percentages of the five types of NTC prospective customers vary from one type to another. These customer segments sizes in descending order are civil society, elderly people, academia, enterprises and municipalities. NTC tailored activities exposure to each of the beneficiary customer segment reflect fulfilling the needs of the corresponding segment. Channels between NTC and customers comply with the main characteristics that should present in customer channels, recommended by literature. Each suggested channel passes by five phases of channeling provision which are awareness, evaluation, purchase, delivery and after-sales support. The recommended customer relationships found in section 4.4 ensure durability and customer retention to NTC activities. The suggested relationship per customer segment help in constructing a long-term relationship with each customer targeted group. NTC revenue streams are expected to increase by increasing the center workload and acquiring more lead customers. Analytically at some point, the revenues shall exceed the costs which result in self-sustainability. On the contrary, that is not expected during the early stages of NTC sustainability plan execution. There exist numerous varieties of NTC key activities which can be offered to customers. Increasing the activities diversity and relevancy results in positive increase in revenues versus costs and more lead customers. NTC resources are mainly physical, intellectual and human. Depending on the annual activity plan for the center, each of the resources categories should be adjusted accordingly. Intellectual resources are one of the edges in which NTC is basically build upon. Building up new partnerships can significantly help pushing the business towards self-sustainability and endurance. NTC currently has the potential and the capabilities that allow gaining more partners.

The conducted SWOT analysis in section 4.10 is very helpful and very promising. It shows that the useful factors are exceeding the harmful factors. Also it highlights that

NTC strengths and opportunities can be affected negatively if the weaknesses and threats are not mitigated. The SWOT analysis speculations are strengthened by Monte Carlo Simulation found in Chapter 5. The conducted simulations using the Monte Carlo method highlighted that adding more relevant NTC services to customers will result in an increase in revenues. Simulations confirmed that the fail to extend NTC operation to other Nordic countries is considered a threat to NTC as a business and the successful extension packed by NTC reputation yields a positive output from the revenue versus costs equation. Also simulations showed that the services pricing patterns and the monthly conversion rates can be manipulated by NTC staff in a way to maximize revenues.

As a next step, it would be beneficial that an entire NTC sustainability plan should be devised upon this Business Model Canvas as the main building block of it. This conducted investigative study is built based on the actual available resources of NTC so whenever an input parameter of the business model changes then the canvas should be fine-tuned accordingly. Monte Carlo Simulations are advised to be used for getting validations for the changes done to the sustainability plan. Real statistics about each building block can be collected and manipulated using the analytical simulation method. After applying the recommended business aspects in reality, an evaluation report should be devised to assess what was achieved and what was not in order to feedback and evaluate the designed NTC Business Model Canvas.

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