

# Acronyms

**NFF** Norsk Fysioterapeutforbund

**SDK** Software Development Kit

**FTE** Full Time Equivalent

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# Chapter 1

## Introduction

### 1.1 Scope

### 1.2 Problem Definition

Games are becoming more and more important in the health sector. One specific genre of games is exercise games (exergames). In this assignment we will focus on the business opportunities and economics of games in the health sector, with special focus on exergames for rehabilitation and elderly. The work has been done in collaboration with Cyberlab, a company focusing on serious games for education and training. The work will provide input to an EU funded project focusing on elderly afraid of falling.

In particular, the following studies will be done:

- A background study of exergames in general and exergames for rehabilitation and elderly in particular.
- A description of specific business cases.
- Analyzing the business potential of this type of games in the health sector using Osterwalder business model.
- Miscellaneous aspects to consider about this type of game

## **1.3 About the Project**

This project assignment is based on an EU-funded project called "GameUp". The purpose of "GameUp" is to use technologies that are proved to improve motivation to encourage elderly to be more physically active. The goal is to sustain and enhance mobility in older persons so that they can live longer at home which will result in a better quality of life. To achieve this they want to increase physical activity capabilities in order to increase motivation and self-efficacy towards mobility. For making it convenient and easy to use, they will develop a platform for social and exercise games using low cost motion sensors and commercial modules and products [1].

This project is a European cooperation with different partners involved. One of these partners is Cyberlab, a small company located in Trondheim. They are working with developing simulators and simulation-based games primarily for technical education and training, but also for promotion and exemplification of technical products and services (nesten avskrift fra deres hjemmeside, [2]). Their work in the "GameUp" project is to develop an exercise game using Microsoft Kinect as a platform. (Tor-Ivar).

## **1.4 Limitation of Scope**

## **1.5 Related Work**

## **1.6 Outline**



# Chapter 2

## Motivation

### 2.1 The Problem of Falls

Falls are very common in the older population. Even though it does not necessarily seem like a very serious event, it is actually the leading cause of injury in older people. Fall is considered a public health problem because of the serious consequences for the person falling and their considerable cost to the country [3]. It is estimated that around 30 percent of people over 65 years old and almost 50 percent of people over 80 years old fall at least once a year. 1/10 of these falls results in fracture and one-fifth needs medical treatment. Other serious outcomes of a fall include pain, trauma and impaired function [3]. The worse outcome of a fall is death. 25 percent of elderly getting hip fracture after a fall, dies within a year [4] [5]. It is shown that after a fall one-third will be afraid of falling again. Being afraid of falling makes them insecure which can result in an even bigger risk of falling. For many elderly, the fear of falling can result in them being less active and a loss of confidence in carrying out everyday activities. This can result in fear of leaving their house, which can lead to total inactivity. The latter is a serious problem because a long time of inactivity will result in disabilities and increased risk of falling. Therefore it is important to find ways to activate the elderly and to offer a service that can prevent

the elderly from developing disabilities [4]. Another issue is that missing the ability to carry out everyday activity can result in loneliness and even depression (site dette? ). Falls are also resulting in an increase in economic costs, including both the acute treatment after a fall and often also in long-term care. [3]

## 2.2 Existing Prevention Programs

To prevent developing disabilities elderly should regularly perform a training program that strengthen their muscles, improve balance and coordination, endurance and mobility [4]. These kind of training programs are offered in Trondheim. There has been established various fitness groups; do you want to get back in shape and become physically stronger? do you feel unsteady and see the need for better balance? Do you manage less now than you did a year ago? Do you find it difficult to go outside? These fitness groups find place at various locations around Trondheim and are offered 1-2 hours one day a week. In addition there exists senior dance, walking groups and water gymnastics [6]. These activities are good initiatives, but when the main problem for Olga is that she's afraid to go outside, how will she manage to engage in these fitness groups? It is also shown that 2 hours a week with physical activity is not nearly enough to increase Olga's physical strength [4]. Regular physical activity is the key to become physically stronger and obtain better balance.

Trondheim municipality did a study where they provided a once a week group training program for elderly. Their study showed that training once a week did not improve physical function for the participants, but the participants expressed that they were less afraid of falling after starting with the group training. The study suggests that this kind of program should be combined with home training programs or other extra physical training offerings [4].

We found that there are already some offered training programs for elderly that can be implemented in their home:

The “*Otago*”-program is a program developed as a home training program for elderly to prevent falls. It consists of exercises that take about 30 minutes to complete which should be performed three times a week in addition to a walk twice a week. Each customer receives a booklet with instructions for the individual exercises prescribed in addition to ankle cuff weights. The participants need to record the days they complete the program for follow-up purposes. For follow-up an instructor should do home visits every six months and telephone them every month. The instructor can then increase the difficulty in the prescribed exercises for each individual. The program has been tested and evaluated for 1016 home living people aged 65 to 97. The program was shown to reduce falls and falls related injuries with 35 percent, with the highest effect on those over 80 years old and those that have had a previous fall. The participants experienced improved strength and balance, as well as they maintained their confidence so it was easier for them to do everyday activities without being afraid of falling. [3] [4]

*Falls Management Exercise* (FaME) is an exercise program consisting of tailored group and home-based exercises and builds on the core exercises from the “*Otago*”-program. There are a total of three group training sessions per week, in addition to two home-training sessions per week. The exercise intervention is designed to improve participants dynamic balance and core and leg strength. In the United Kingdom a study was done where they examined the effectiveness of this program for home-living women aged 65 or older who had already fallen 3 or more times within the previous year. After using FaME for 36 weeks the fall rate was reduced by one-third. The conclusion of the study was that the exercise program should last for at least 36 weeks including at least 2 hours of training per week. For progression it is important that the intensity, resistance, and weight are continually increased, as well as the balance gets challenge. [7]

*Øvelsesbanken* is a Scandinavian project providing a user profile with different training programs. The different exercises are developed from the two previous described concepts and other relevant studies on balance and exercising for elderly. The program gives an idea on how you can put together an exercise program customized for each individual. It is primarily made as a tool for physiotherapists for putting together training programs for their patients to do at home. As we see it, it can also be used as a tool for each individual to put together their own program, because you can also log in as a private user and make your own program. The program offers the user a choice of different exercises that you can add to your exercise program. When all exercises are chosen you can print out pdf-files with pictures and descriptions or you can read from the computer screen. It is an easy, self-explanatory and straightforward program to use. *Øvelsesbanken* is in use in Scandinavia and the summer of 2012 it had reached 4300 users. [8]

## 2.3 Exergames used as a Exercise tool

The new generation of video games that combine game play and physical activity is called exergames, and it has shown promise in effecting users health in a positive direction [9]. Exergames has proved to be motivating because of its easy understanding, accessibility and fun. This type of games are suitable for people in various age groups because most of the games does not require any prior knowledge of either computers or video games [10]. Use of exergames is also an important factor to the social aspect, because of the possibility of playing with others, something that will be entertaining for elderly who are often alone and experience loneliness as a part of the everyday life [11]. It has also been shown that this type of exercise improves moods [12]. The feeling of accomplishment users get from reaching goals, completing exercises and being in physical activity increases the users mood. This combined with the social interaction you get from playing provides a desire to play again [11] [12]. Exergames has

shown promise in rehabilitation of balance after stroke and damage to the spine. The use of exergame also has an appropriate use in exercise and rehabilitation, because the fun and challenges you get through the game could take the focus away from boredom and any physical pain [11] [13]. Today there exist numerous games of this type, but very few commercial games are suitable for the focused, controlled exercise required for therapy [13]. The existing games are unfortunately too complicated, too rapidly and too difficult to handle for the elderly, and they have too complex and cumbersome consoles [11].

## 2.4 Example Case

78 year old Olga lives in her own apartment in central Trondheim. Everything she might need is situated in the area, but lately she has started to feel unsteady and has trouble keeping her balance, making sure she does not go out more than necessary. Trondheim is also very icy most of the winter, which increases Olga's fear for falling. Basically, Olga is a very social person, but lately there has been little contact with friends and other people in general because of the fear of going out. Olga has no close family nearby. Beside the unsteadiness, Olga is well and without any physical pain, and thus has no need for physiotherapists. Olga has a great desire to be more steady on her feet so that she can gain an increased social contact, and particularly increase her confidence.

Olga has a grandson who is very into video games. Once a year he is visiting her and every time he tells her about the different games he is playing. Sometimes he also brings games to her house to play there, and she is watching enthusiastically. One time he told her about a new game he got for his birthday, a game where he did not need any controllers, but could only stand in front of the TV screen making movements that would appear on the screen. He also told her about how you could get different exercise games for the controllers and that this is starting to get very popular in the general population. Olga thinks this sounds very interesting,

but at the same time it is too intimidating for her to even consider to buy.

Two months later, Olga feels that she has become weaker after being inactive for so long. Her daughter recommends her visiting a physiotherapist. The clinic is only a couple blocks away from her house, but everyday before her appointment she is worrying about how she will get there. When the day arrives, she is so anxious that she ends up ordering a taxi.

The physiotherapist meets her in the door, and follows her to his office. After being examined the physiotherapist introduces her to a new project they have just started at his clinic. He tells about an exercise program as a video game that is specially made for elderly people. At first it will just be provided at the clinic, but eventually, if the use of the game is a success, they plan to offer it for patients to rent or buy. The program will contain one playing session a week, and will be played by up to four players. At first, Olga is very sceptical, but then she suddenly remembers her grandson playing a similar game in her living room a couple of months ago. She is thinking that even though the game looks very intimidating at first sight, here she will at least get some assistance. She decides to sign up, but has one concern. How will she get to the clinic? The physiotherapist tells her that as part of the program, they will offer the participants transportation to the meetings until they feel confident getting there themselves. The main goal for the game is to strengthen muscles and improve balance, so after a while the participants should see improvements.

One week later, Olga visits her first meeting. None of the participants in her group have tried the game before, so everyone gets an thoroughly introduction. Then they start playing. Olga thinks the game is self-explanatory and very easy to understand, and she get through the first level without any problem. A physiotherapist is watching them at all times and is guiding them through the game. After the session is over, Olga is tired, but she feels good. What she liked most about the game was how fun it was to compete with the other participant. They motivated and engaged each other. She is already looking forward to the next session.

## Chapter 3

# A Background Study

To be able to understand the overall picture of the game Cyberlab is going to develop; how the game can and should be developed; what kind of technology should be used: how it can work as a substitute to an exercise program or an additional offering and how this can work in an existing physiotherapist service, we have to describe each of the entities alone. In this chapter we will describe how fall prevention is done today, what video games, and in general exergames, are, the different type of exergames relevant for Cyberlab's game and at last we will bring fall prevention and rehabilitation together with exercise games by looking at some previous research.

### 3.1 Fall Prevention and Rehabilitation Today

Physiotherapy is a science related to the medical field and central to this subject is body and movement. The theoretical basis for this subject is grounded in knowledge about science and society, and the recognition that different factors contribute to the maintenance of health. In addition to injuries and diseases, quality of life, experiences as well as social and cultural factors leads to pain and disability. This understanding along with practical and clinical knowledge forms the basis for evaluation of how injuries

and pain can be treated and prevented. Physiotherapy can be described as examining, treating and preventive. Included are manual techniques, exercises and possible use of technical methods. The subject of physiotherapy is performed by a physiotherapist. Physiotherapists are traditionally working in municipalities, hospitals and in private institutions, and they are working with both individual treatment and treatment in groups. The goal for physiotherapists is to make their patients' daily activities easier to manage [14] [15].

Elderly people consult physiotherapists' in terms of rehabilitation after surgery, after a fall, stroke or other injuries, or when they feel health problems make it hard to perform everyday tasks. Physical therapy usually includes exercise with focus on increasing the patients' flexibility, endurance and strength. Physiotherapists sets up customized training for each patient according to what kind of needs they have. Unfortunately, the time a patient spends with the physiotherapists per week is not sufficient in order to become stronger or to recover from injuries. Therefore, one sees the need for patients to practice outside of these hours at the physiotherapists. Physiotherapists may give their patients exercises they can practice at home. However, not everyone is motivated to exercise on their own and many skip the weekly exercise that is scheduled for them. [15]

## 3.2 Video games in general

Video games are electronic games that involve human interaction with a user interface to generate visual feedback on a video device. (wikipedia forelpig)

The first graphical computer game was created by A.S. Douglas in 1952. This single-player "game" was based on a version of Tic-Tac-Toe and the title of the game was "OXO". "OXO" was designed for academic purposes. Douglas wrote a PhD degree on Human-Computer interaction, and used feedback from the electronic "OXO" in his work [16]. Ralph Baer, a



German-born television engineer, designed in 1967 the first video game console for use on standard television. "Chase" was the name of the game, and here two players were connected to a television where they controlled two squares which they used to chase each other [17]. Various features were added to this idea, and this ended up in 12 games known as the Brown Box. Baer introduced his idea to Magnavox, and in 1972 the first commercial video game called Magnavox Odyssey was produced. TV dealers did not see the potential in the Odyssey, so it didn't get very popular, and the market experienced a video-game crash. In 1985 the first Nintendo Entertainment System were released. Retailers were skeptical to marketing a new console soon after the video-game crash, but the games Nintendo introduced got popular, and soon Nintendo broke sale records and become the best-selling console in video-game history [18].

The Nintendo Wii is one of many gaming consoles, and it is worldwide very popular. It has sold over 30 million units in the US and in Japan there has been sold almost 10 million. These numbers combined with the international market gives a total sale of Nintendo Wii of 65.32 million units. However, the bestselling console ever is the Sony PlayStation 2, with over 138 million units sold. The bestselling video game series is the Mario franchise, with a sales number of over 225 million games [19]. DFC Intelligence is a marked research and consulting firm which focus on interactive entertainment and game markets. The global market for video games experienced revenue of 67 billion dollars in 2012, and in DFC Intelligence's new reports they forecast that the global video game market is expected to reach 82 billion dollars in 2017. This number includes revenue from console hardware and software, PC games and games for mobile devices [20] [21].

In the last 30 years there has been a great evolution in video games. Several popular games and consoles, like e.g. Gameboy and PlayStation, has been developed, and today there exists a huge amount of various video games and consoles. Video games have become widespread entertainment, and in the US 65 percent of all households play video games. The majority of these gamers are players in the age of 18-49, and today the average age for a US

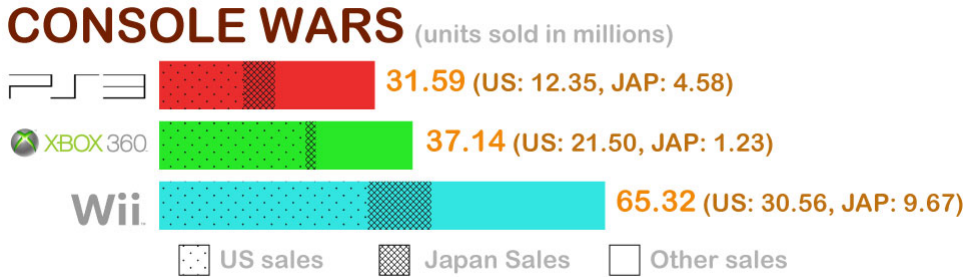


Figure 3.1: Console war 2012 [19]

gamer is 32 years old. There are a significant difference between the gamer age distribution in the US and Norway, see Figure 3.2. In Norway, a greater share of the population under the age of 19 is entertained by video games, and the gamer majority is shared between the two younger age groups. In 2010 the average gamer played video games 8 hours during a week, and in 2012 this is more than doubled, when gamers today spends 18 hours a week playing video games. Video games are used for various different purposes, like education and learning, exercising or just pure entertainment [22] [19].

A maybe surprising fact about the gaming statistics in the US is that as much as 2 out of 5 gamers are women, and that there are more gamers over 50 than there are gamers under 18 [19]. "Norsk mediebarometer", a report containing statistics around the topic of media use in Norway, show that 17 percent of the Norwegian population plays computer or video games on an average day in 2011. This includes not only children and teenagers; also a great part of elderly has started to use computer or video games. 8 percent of the population in the age 45 - 79 years use this kind of technologies on an average day, see Figure 3.2, where females are the most active gamers. The US has a higher number of gamers over 50, but the statistics shows that use of computer and video game in Norway has increased from 5 percent

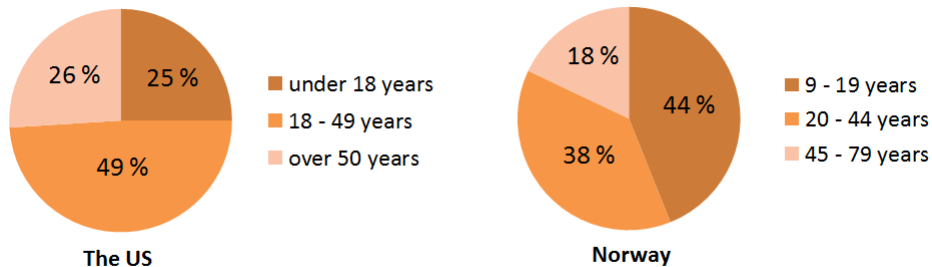


Figure 3.2: Gamer age distribution in the US in 2012 [modified from [19]] and in Norway [calculated from [24] [25]]

in 2010 and this measurement are the highest share ever recorded [23] [24]. (SKAL jeg si noe om at ingen i aldersgruppen 67-79 bruker kun TV-spill?)

### 3.3 Exercise Games

When video games are brought together with exercise, we have what is called Exercise games, or "Exergames". Technology for tracking body movement, like motion sensors and remote controls, require the players to move which stimulates exercise. The combination of movement, fun and social interaction provides exergaming great potential for new business opportunities for the entertainment, recreation and healthcare sectors [26].

Today there exist numerous types of games and technologies, where Nintendo Wii, Dance Dance Revolution, PlayStation Eye Toy and Xbox Kinect are some of the more familiar technologies. This genre of games has become very popular, and due to the growing interests one has seen it as relevant to study the use in regard of health and education. The technology these games provide can in an interesting way help provide health-related infor-

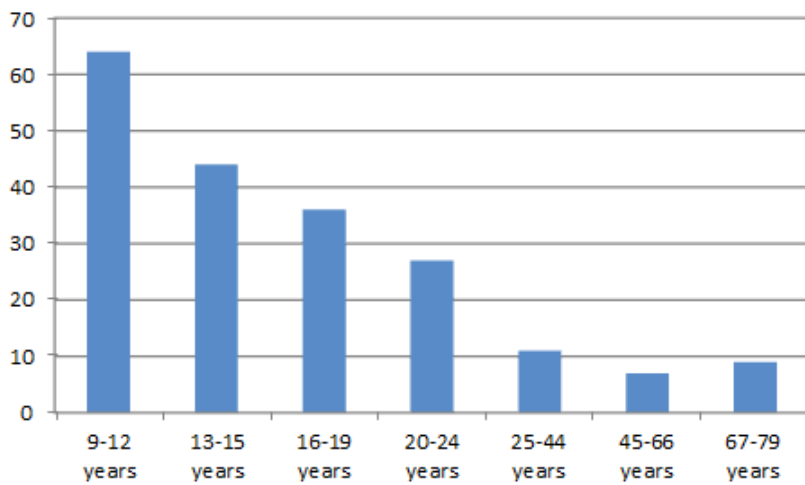


Figure 3.3: Percentage of the Norwegian population that use computer or video games on an average day in 2011, sorted by age” [24]

mation to specified target groups [26]. In the past years exergames research has increased dramatically, and indications show that it will continue to do so [27]. Research shows tremendous promise in academic, social and physical progress of youth using exergames. The health sector is now more focused on prevention of illness instead of treatment, where this type of research can contribute to use of exergames in health care [26]. Games like Wii Sports and Dance Dance Revolution were designed to encourage physical activity, but many currently available exergames were not designed for this purpose. The popularity of exergames and the increasing customer appeal will improve design principles and physical requirements [27].

We will now describe some of the different video game consoles that can be used for exergaming.

### **3.3.1 Dance Dance Revolution**

Dance, Dance Revolution (DDR) is a series of video games created by Konami Corporation's Bemani music games division. DDR is a rhythmic dance simulation game and was first released as an arcade game in 1998. In few years it became very popular, and the game has had its appearance on several game console systems like Sony PlayStation, Nintendo 64, Microsoft Xbox and Nintendo GameCube [28]. DDR uses a touch-sensitive dance pad with sensors to register movements, where one shall press the right sensors in proper time with electronic dance music. Arrows on-screen gives direction on how and when to move around. The DDR games have varying difficulty, requiring different levels of physical activity. GetUpMove.com is an information website about the use of PlayStation Dance Dance Revolution as a weight loss tool. This site was launched in 2004, and one of the highlighted stories was about a young woman who lost about 95 pounds by using DDR as an exercise tool. This and similar stories got widespread exposure, and consumers started to buy DDR solely for the purpose of exercise [28]. In 2003, 5 years after the first release, Konami announce that DDR has reached a total sale of 6,5 million units worldwide [29]. 8 years later, in 2011, the number of sold units had reached over 13 million, which

is about 1 million units sold every year since the first release in 1998 [30].

### **3.3.2 PlayStation EyeToy**

In the early 2000s the PlayStation 2 EyeToy was released by Sony Inc. It was the first in this category of games to introduce a device that could translate human motions into a controller input and allow players to physically interact with virtual objects using their own body and without being connected to wires. [31]. Human body movements are translated real-time into the controller input by a USB camera and can also map the player's face onto in-game characters. Eye Toy is easy to set up and its applications offer a lot of different environment and can be played by one or more players [32].

### **3.3.3 PlayStation Move**

PlayStation 3 Move was released in September 2010. The PlayStation Move's interface consists of the Move Eye, a RGB camera with directive microphones, and the Motion Controller, a wand with an illuminating sphere attached to it. The camera can detect the sphere and determine where the wand is, which allows the players to interact with the PlayStation 3 through motion and position. The sphere attached to the wand helps the camera to determine the distance from the wand to the camera and to track the controllers position in three dimensions. The wand is equipped with a three-axis accelerometer and a three-axis gyro sensor which are used to track rotation in overall motion and can also be used to detect if the wand is out of range (i.e. hidden behind the player back). It also consists of a geomagnetic sensor used to calibrate the wand's orientation against the Earth's magnetic field, which makes it possible to recognize the wand's position accurately. (hmmm... hvordan kan denne setningen skrives på en annen måte?) [33]. Up to four wands are supported at one time, which makes it possible for four players to play together. The color of the sphere can be changed to any color and is usually used to show what player is active and to give visual feedback [34]. The SDK is not made public, so its

difficult for a third-party to make original applications [33].

### **3.3.4 Nintendo Wii**

Nintendo Wii was released in 2006 as the first motion sensor game. Only one year and 20 million units sold later, it became the market leader of that times generation of consoles. It consists of a Wii remote, which is the primary controller and a secondary controller called Nunchuk. The Nunchuk is connected at the bottom of the Wii remote control [35]. The Wii remote contains 12 buttons, a 3-axis accelerometer, a high-resolution highspeed IR camera, a speaker, a vibration motor, and wireless Bluetooth connectivity. Each Wii remote has a IR camera sensor on its tip. The camera ship can track up to four simultaneous IR light with high resolution and high speed. The accelerometer within the remote control provides the Wi remote's motion-sensing capability. The Wii remote has a total of 12 buttons and the buttons are arranged symmetric so that both hands can be utilized. A vibrator motor, LED lights and a small speaker are used for different kinds of user feedback, like varying light strength and sound-effects. The four LED lights are also used to indicate the different players ID. Communication is sent over the wireless Bluetooth connections, which enables up to four controllers to be connected at the same time. The users of Nintendo Wii can make their own personal profile, called Mii, where the data of the player will be directly connected up on the remote used. To operate, the remote needs two AA batteries [35] [36]. By December 2010 over 75 million Wii consoles were sold. To complete the original system with improved accuracy and response time, Nintendo made an enhanced version, Wii Motion Plus, which was released in November 2009 [37]. There are several SDKs for Nintendo Wii open, which makes it possible for a third party to develop applications which utilize the controller [33].

### **3.3.5 Wii Balance Board**

The Wii Balance board is an add-on accessory for the Wii Fit, which is a video game created by Nintendo to work with the Wii platform. Just like

the Wii Remote controller, the balance board can read your body movements and give them back on the screen as you are playing [38]. The balance board contains multiple pressure sensors which track body movements. The board has a area of 551 mm \* 316 mm. A third party can also build applications for the balance board using the SDK WiimoteLib [33]. It has been shown that game-based balance programs like Wii Balance Board compared to traditional training is easier, more motivating and more enjoyable [39].

### **3.3.6 Microsoft Kinect for Xbox 360 and Windows**

Microsoft Kinect was released in 2010 and became quickly extremely popular. Only 25 days after its release it had sold 2.5 million units and by January 2012 Xbox 360 had sold over 66 million consoles and more than 18 million Kinect motion sensors [37], [40]. Microsoft Kinect is a flexible low-cost motion sensor device for the Xbox 360 game console and for Windows PCs that can track human motion. It is a webcam-based add-on peripheral for the console, which enables the user to play and interact with the game without physically holding a sensor device. Instead the player can interact with the game console through a natural user interface using gestures and voice commands ([41], siste setning kanskje litt avskrift.. se på senere). The device gives full-body 3D motion capture capabilities and gesture recognition by help of a RGB camera and a depth sensor [41]. One advantage with Kinect is that it has an interface that senses players various motions and it also senses other objects in the field, which makes a natural environment where the players can interact with virtual objects in the real world. [33]. It also exists a Kinect sensor for Windows. The sensor is designed to operate on computer running Windows 7, Windows 8, Windows Embedded Standard 7, and Windows Embedded POSReady 7. All the users need is the Kinect sensor, a computer and a Kinect for Windows application. Kinect for Windows SDK was released in June 2011 and enables developers to build Kinect applications with C++, C# or Visual Basic using Microsoft Visual Studio 2010. This enables any third party to develop Kinect for Windows applications. [42].



### 3.4 Using Exergames for Fall Prevention and Rehabilitation: A background Study

Games are becoming popular as a tool for exercise and rehabilitation. There have been a lot of different studies done on how some of the previous described types of video game consoles can be used for this. Most of the studies have been done on adolescents, but there also exists some research done directly on elderly. In this section we will review some of the interesting findings we did.

Taylor et al. [39] did a study where they searched through already done studies to draw a picture on how games can be used for exercise and rehabilitation. They reviewed some of the interesting findings they did in their paper. From the studies they reviewed they found a trend; the Energy Expenditure (EE) while playing Wii was greater than when doing sedentary activities, but not greater than brisk walking. This suggests that playing Wii sports could not replace real sports activities. Playing DDR on the other hand, maximum heart rate and oxygen consumption were greater compared with Wii Tennis, suggesting that DDR can substitute physical activity. In their research they also found a study on what attitudes people have against DDR to encourage exercise. 40 postmenstrual women, aged 45-75 years old were asked. The overall attitude was positive; The game was fun and it gave a potential to improve coordination. However, they also expressed a concern about a long learning process. It is also found that playing against a human gave greater arousal ratings and physiological responses to gaming than when playing against a computer, which benefit the enjoyment, suggesting that this can be beneficial for older people. From their study they can conclude that computer-based rehabilitation is not a new phenomenon and that one of the main reasons for this is that games have the ability to increase motivation and produce distraction from daily, boring and painful treatments. Wii is seen as an attractive game for rehabilitation, both at home or in institutions. Wii is actually already in use within the National Health Service in UK and is commonly used for

the elderly and patients with pathologies. [39]

Another study they found was that non-disabled elderly (70 +/- 5,7 years) was positive to the EyeToy; they enjoyed it and found it easy to use. For patients with stroke it appeared to be less suitable, which could be even worse if they had to hold on to a controller. This suggests that EyeToy is more suitable for patients with stroke than for example Wii. (litt usikker om vi bør ta dette fra den original kilden eller ikke) Even though these type of games are initially meant as entertainment systems, there are a number of studies that have used the hardware and developed software to turn for example the Wii into a useful rehabilitation tool. The importance of these games are entertainment that motivates for actual sports. This is very important in for example rehabilitation. [39]

Staiano and Calvert write about how exergames are more and more used in the health sector. Gaming consoles are already integrated into equipments at gyms and health clubs. An example is Concept 2's rowing machine. Here the people exercising are motivated through competition and through virtual trainers who monitor their progress and encouraging them to proceed to the next level. Also some schools are starting to integrate these games into their curriculum. In all of West Virginia's 765 public schools they have integrated DDR in their physical education. This has proven to be very effective and popular and some students lost 5-10 pounds after playing DDR daily. [12].

Williams et al. did a study to see if exergames, more specifically Nintendo WiiFit, was an applicable type of exercise to reduce the falling statistics of community-dwelling people over 70 years. A group who attended WiiFit exercise sessions was compared with a group who went to a local falls group. 77 percent of the participants said that if the exercise programme was more available, people like themselves would use it. 92 percent of the participants expressed that they wanted to exercise with the WiiFit in the future, while 61 percent would choose to exercise with the WiiFit rather than attend a

falls group. An improvement in Berg Balance Scale (BBS)<sup>1</sup> at 4 weeks was seen in the group that played WiiFit, meaning that there is a potential to improve balance in this population. Despite this, there was no change in The Falls Efficacy Scale - International (FES-I)<sup>2</sup> at 4 weeks. The qualitative data for the group that played WiiFit showed improved confidence for the participants. The conclusion of the study is that WiiFit is acceptable in older people with a history of falls and that it has the potential to improve balance and confidence. Further work has to be done to find and develop an acceptable exercise programme with the potential to improve balance in older individuals. [43]

Chang et al. did a study where they prototyped a Kinect game that was designed to help motivate people with motor disabilities to do their exercise more frequently and to improve the motor proficiency and quality of life. Because of the inconvenience of having to wear sensors in some of the other relevant technologies, Chang et al. chose to use Kinect. They developed a game, called “Kinerehab”, that was meant to assist therapists in rehabilitating students in public school settings. To detect the students’ movements Kinerehab uses image processing technology of Kinect. To engage and motivate the student for physical rehabilitation, the system is made with an interactive interface that has both audio and video feedback. For making it easy for therapists to review the progress of each students quickly, the system also includes details of students rehabilitation conditions which is automatically recorded in the system. Two students, a 16 year old girl diagnosed with having acquired muscle atrophy and insufficient muscle endurance, and a 17 year old boy diagnosed with cerebral palsy, were chosen to participate in the study. The girl used a wheelchair and could only stand with assistance. The study included two phases: a baseline phase where no assistive technology was applied, and the intervention phase where the Kinerehab was used. Both phases were done twice, beginning with the

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<sup>1</sup>Berg Balance Scale (BBS), a performance based measure using 14 activities of daily living (range 0-56) [43]

<sup>2</sup>The Falls Efficacy Scale - International (FES-I)  
(<http://ageing.oxfordjournals.org/content/34/6/614.short>)

baseline phase, continuing with the intervention phase and so on. In both phases the same exercises were done. The result showed that both participants increased the number of correct movements significantly in the intervention phase. On average the number of correct movements was 49 in the first baseline phase (5 sessions), while 170 in the first intervention phase (11 sessions). Both students indicated that the game motivated them to do the exercises and that they wanted to continue using it. The therapists said it would increase their workload a lot. This suggests that Kinect can be a viable rehabilitation tool, but further work, where more people with disabilities participate, should be done. [41]

Et konkluderende avsnitt her...

## Chapter 4

# Osterwalder's Business Model Ontology

We have decided to use Osterwalder's Business Model Ontology for the analysis of the case. We analysed both Alexander Osterwalder's phd thesis [44] and his textbook "Business Model Generation" [45] and our own synthesis of them. The thesis is a thoroughly description, while the book is easy to understand and on a more user friendly level. The foundation of our description lies in the textbook, with some details that we found important from the thesis. In this way we got an description that is suited well into our case analysis.

Osterwalder defines a business model like this: "A business model describes the rationale of how an organization creates, delivers, and capture values" [45]. Osterwalder came up with a way to describe business models through nine building blocks. Going through these building blocks allows us to describe and think through the business model of any enterprise by covering four main areas of a business: Product, Customer Interface, Infrastructure Management and Financial Aspects. The nine different building blocks are: Customer Segments, Value Propositions, Channels, Customer Relationships, Revenue Streams, Key Resources, Key Activities, Key Part-

nerships and Cost Structure. The nine business model elements are the core of the model, see Figure 4. In this chapter we will go through every of the nine building blocks in more detail. [45]

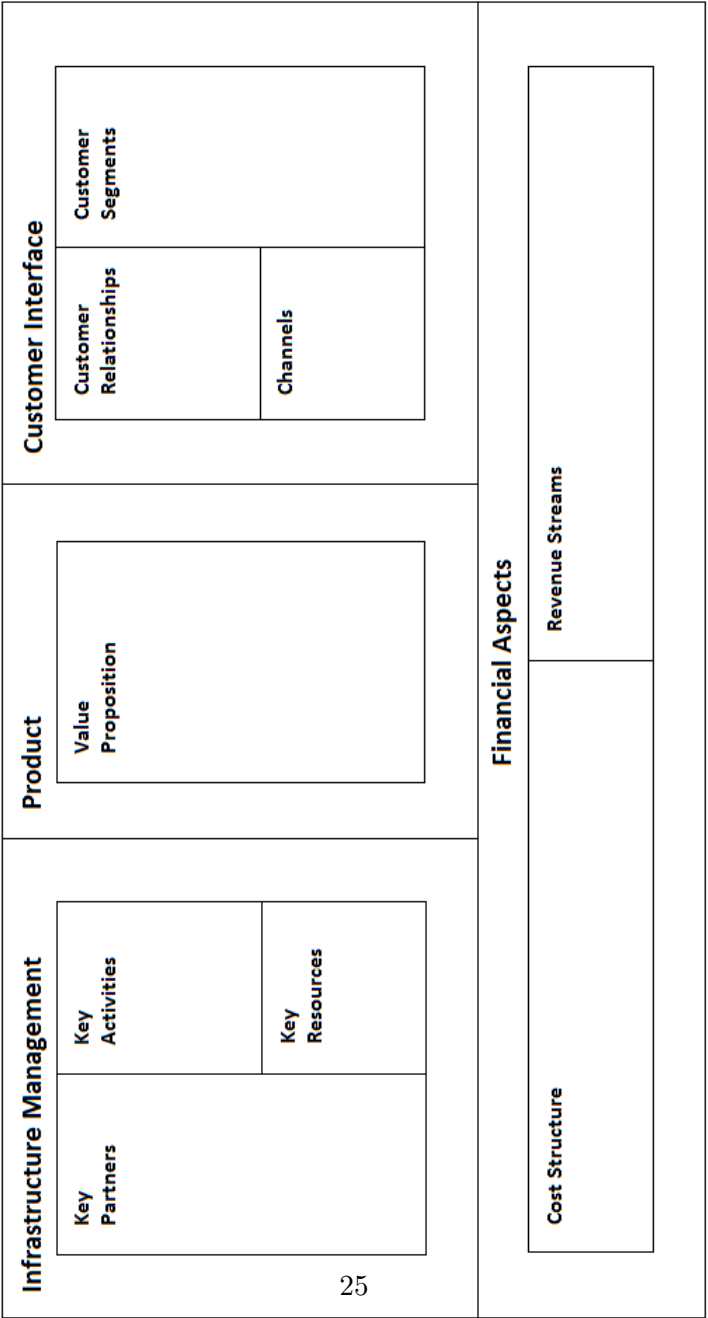


Figure 4.1: The Business Model Canvas [modified from [45]]

## 4.1 Product

Product is what the company offers to its customer and how it differentiates itself from its competitors. This area covers the building block Value Proposition [44].

### 4.1.1 Value Proposition

Osterwalder's definition is: "The Value Propositions Building Block describes the bundle of products and services that create value for a specific Customer Segment" [45]. This is what the organization actually offers to their customer or customer segments and are suppose to satisfy the customers needs. It might be different value propositions for the different customer segments. The values can be both quantitative and qualitative, meaning that the value can rely on for example price or on design. The value propositions have to be so good that the organization's defined customer segments turn to them over another company. It can be either something new, an improvement of already existing products or services, customized products and services or simply just helping a customer to get a certain job done. Something to also consider is design and brand. These two aspects are more important in some type of products than other. It is also important to compare price levels with their competitors. A common way to satisfy the needs of the customer is to offer them the same value to a lower price. The firm can also keep-up with the market price, offer luxury goods to a higher price or simply offer a Value Proposition for free. For the latter, the model is based on an other source of income, for example advertising.

There are different ways of creating value for the Customer. By reducing the cost, this will for most customer be experienced as valuable. Also reducing the risk when buying something, by for example offering them one-year guarantee is very satisfactory for customers. Other ways of creating value are to make products and services available for customers that did not have access to them before and to make products and services easier



and more convenient to use. [45]

## **4.2 Customer Interface**

Customer Interface covers everything that have to do with customers: who they are, what kind of relationship the firm has with them and how the firm reach out to them. The three building block covered by this area are thus: Customer, Channel and Customer Relationships, described below. [44]

### **4.2.1 Customer Segments**

Osterwalder's definition is: "The Customer Segments Building Block defines the different groups of people or organizations an enterprise aims to reach and serve" [45]. To make a good business, you have to understand who the business are meant to create value for, which is all about segmentation. It is important to carefully choose the most important customers and to focus on them and their needs. A business can have more than one customer segment, but they can not always serve all segments. Therefore a careful valuation has to be done to choose the organizations most important segment(s). [45] [44]

A firm can deliver a value Proposition to different types of Customer Segments. They can choose to not distinguish between customer segments and rather focus on the mass market, they can distinguish their customers into segments with slightly different needs or problems, or sharpen it even more by targeting a niche market with specialized customers. The firm can also serve unrelated Customer Segments or even independent Customer segments. [45]

### **4.2.2 Channels**

Osterwalder's definition is: "The Channel Building Block describes how a company communicates with and reaches its Customer Segments to deliver

a Value Proposition” [45]. This is about finding the best and most cost-efficient way of reaching the right customers, at the right place and right time [44]. We distinguish between five channel phases, shown in figure 4.2.2. A channel should be studied over all these phases. It is important for an organization to think about how the customers want to be reached in all of these phases and how the channels can be integrated with the customers routines. The way the organization communicates with the customers is an important role in the customer experience. The value proposition can be delivered either directly, through for example sales force, or indirectly through intermediaries. They can also be delivered through owned channels, partner channels or a mix of both, see figure 4.2.2 ... Her har jeg tatt bort det med links.. [44].

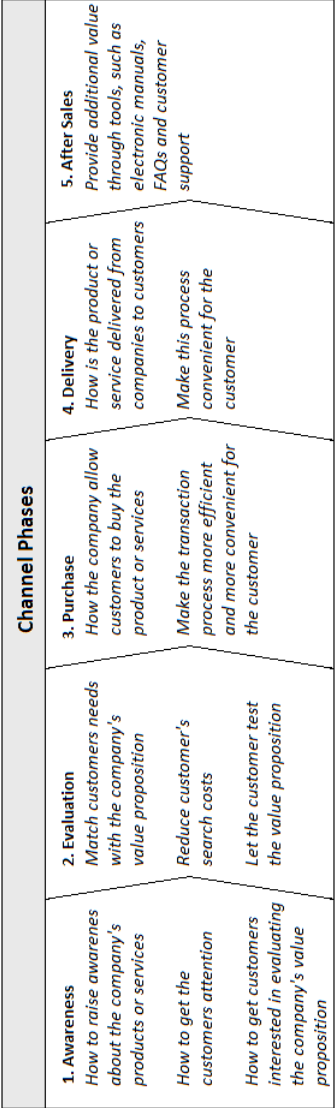


Figure 4.2: The 5 Channel Phases [modified from [45] [44]]



Figure 4.3: Channel Types [modified from [45]]

### 4.2.3 Customer Relationships

Osterwalder’s definition is: ”The Customer Relationships Building Block describes the types of relationships a company establishes with specific Customer Segments” [45]. The customer relationship is very important for the customers overall experience. This can range from personal assistance, where a real customer representative communicates with the customer, to a more automated service, where typically the customer helps himself, to a more community based service that allows customer to exchange experiences with each other. For every type of Customer Segments defined, the organization has to keep in mind what kind of relationship the Customer wishes to have. At the same time, the organization has to keep in mind how this relationship is integrated with the rest of their business model and how costly they are. The Customer Relationship is based on customer equity. There are three different customer equity goals: customer acquisition, customer retention and boosting sales (upselling).

- *Acquisition:* A company needs customers to do business. The customer acquisition is a very expensive affair and must be carefully managed and evaluated because the relationship developed with its

customers will strongly influence the two next equity goals [44].

- *Retention*: “The goal of customer retention is to leverage customer acquisition investments. “j-skrive om. The customer acquisition is usually more expensive than customer retention. Because of this ways to extend the duration of the relationships between the company and its (profitable) customer should be found. High switching costs is an element that can help retention. This means that the cost of ending the relationship and building a new one is so high that the customer does not want to switch [44].
- *Boosting sales (upselling)*: This means adding on to your initial sale with additional products and services [44].

## 4.3 Infrastructure Management

Infrastructure management describes the companies capabilities and resources that are necessary to deliver the value proposition and maintain customer interface. This block also describes who provides and own the capabilities and resources, as well as who executes the activities and the relationship between them [44].

### 4.3.1 Key Resources

Osterwalder’s definition is: ”The Key Resources Building Block describes the most important assets required to make a business model work” [45]. This means all the resources you need to make all the 4 described building blocks work. The resources can be physical (e.g. buildings and machines), intellectual (e.g. brands, patents and copyrights), human (for example in an industry where knowledge is in particular important) and financial (e.g. cash). The company does not need to have all the resources within their organization, they (bedre ord for “de”?) can also be acquired from outside the company. A Resource can be linked to one or more Activities (described below).

### 4.3.2 Key Activities

Osterwalder's definition is: "The Key Activities Building Block describes the most important things a company must do to make its business model work" [45]. This means all the actions that have to be done to make all the 4 first building blocks described work and to generate profit. The main purpose of a company is the creation of value that customers are willing to pay for. This value is the outcome of a configuration of inside and outside activities and processes. Depending on what kind of company it is the configurations can be categorized as a *Value Chain*, a *Value Shop* or a *Value Network*. Osterwalder distinguishes between primary and support activities. Primary activities are involved in the creation of the value proposition and its marketing and delivery. Support activities are the underlying activities that have to be in-place for the primary activities to take place (e.g. firm infrastructure, technology). All the three different types of configurations have different primary activities, as described in figures 4.3.2, 4.3.2 and 4.3.2 [44]:

*Value Chain:*

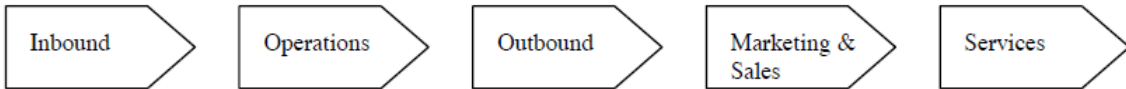


Figure 4.4: Value Chain (5 primary activities) [44]

This is all about how a firm creates value from taking an input, transforming it to the final product (refined output), distribute the product to the customers and maintain the product. At each step there are added value (e.g. production and manufacturing).

*Value Shop:* This figure describes how a firm can create value for its customers by understanding their problem and finding a solution for it (e.g. consultancies and doctors).

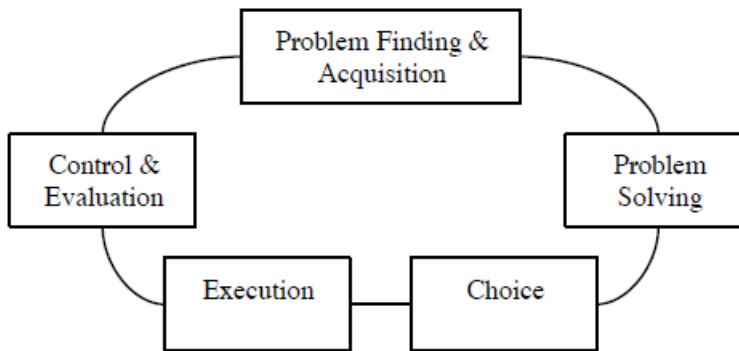


Figure 4.5: Value Shop (5 primary activities) [44]

*Value Network:* This is about network effects, which means that the more people a network has the more value it gets. (e.g. banks and telecom operators). It consists of getting potential customers to the network, establishing links between customers and billing for value received, and maintaining and running a physical and information infrastructure so it is ready to serve customers requests.

### 4.3.3 Key Partnerships

Osterwalder’s definition is: “The Key Partnerships Building Block describes the network of suppliers and partners that make the business model work” [45]. Not always can a company do everything on their own. The motivation for creating partnerships can be divided in three:

1. *Optimizing their business model:* Sometimes it is not profitable for a company to own all resources and do everything in-house. Cooperating with other firms can reduce costs and optimize the allocation of resources and activities.
2. *Reduce risk:* In a very competitive market it can be safer to cooperate

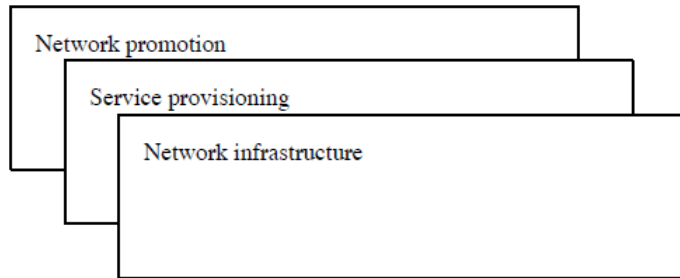


Figure 4.6: Value Network (3 primary activities) [44]

with the competitors in one area, even though they are competing in another.

3. *Acquire resources*: Usually it is not very profitable for a company to have all resources and to have the knowledge to do all the activities. Cooperating with other firms by buying/lending resources is often more profitable than having everything in-house. [45]

## 4.4 Financial Aspects

All of the other blocks already described influence this last block in the framework, thus this block is an outcome of the rest of the business model configuration. This area covers the Revenue Streams and Cost Structure elements [44]

### 4.4.1 Revenue Streams

Osterwalder’s definition is: “The Revenue Streams Building Block represents the cash a company generates from each Customer Segment” [45]. This is where the company earns its money. It is important to keep in mind what the customers are willing to pay, as well as what they are currently paying. A firm can have one or more revenue streams where each rev-



revenue stream can have different pricing mechanisms, shown in table blabla. There are several ways of generating revenue streams, including asset sale (e.g. selling a car), usage fee (e.g. customer pays his telecom operator for the minutes he has spend on the phone), subscription fee (e.g. users of Spotify pay a monthly fee to access Spotify Premium), renting (e.g. renting a car for the weekend), licensing (e.g. companies have to pay a license fee to get access to a patented technology), brokerage fee (e.g. a seller earn a commission each time they sell something.. sjekk denne), and advertising (e.g. newspapers take a fee for companies who wants to promote a specific product or service in their newspaper).

The pricing mechanism chosen is very important and can make a huge difference on how much revenue that is generated. Osterwalder distinguish between two types of pricing mechanisms: fixed and dynamic pricing, where fixed pricing means that the prices are based on static variables, while dynamic means that prices changes with market conditions. [45] TABELL: PRICING MECHANISMS s 33 i boka

#### **4.4.2 Cost Structure**

Osterwalder's definition is: "The Cost Structure describes all costs incurred to operate a business model" [45]. The costs in the business model come from Key Resources, Key Activities and Key Partnerships. The book [45] defines two cost structures: cost-driven business model, which focus on minimizing costs, and value-driven business model, which are focussing on value creation by for example making personalized services. Despite of if the model is cost-driven or value-driven the costs can have different cost structures, shown in figure 4.4.2 [45].

Cost Structure	
Fixed costs	Costs stay the same regardless of the volume
Variable costs	Costs depends on volume
Economies of scale	Less cost as output increases
Economies of scope	Less cost due to a larger scope of operations

Figure 4.7: Different cost structures

## Chapter 5

# Information Gathering

In this section we will describe what kind of methods we have used to make a business model for the Kinect based exercise game.

### 5.1 First Phase

Research and previous work have been well examined, to find out what has already been done within this field, see previous chapters. Based on our foundational knowledge we developed three different business models where we looked at three different customer segments, namely *the end user*, *physiotherapists (and the health sector in general)*, and *voluntary exercise groups*. During our work on the business model we discovered many loose ends, and at one point we could discard some of our theories. We ended up with physiotherapists as our main customer segment.

### 5.2 Qualitative Research

The next step in the process was to do a qualitative research on the chosen customer segment and on fall problematic in elderly. Qualitative research means to get an in-depth understanding of a phenomenon. As a method we used qualitative interviews as a data gathering tool. This is the most

common tool used in qualitative research. [46]

We interviewed three physiotherapists working with the older patient group. Our supervisor helped us get in contact with one physiotherapist, who again put us in contact with other physiotherapists. In addition to that, we contacted some physiotherapists ourselves. We choose to look at both clinics controlled by the government and also one private clinic. The reason why we did this, is because the two entities have two quite different economic models. In the private clinic, the owners are the payers, while in the public clinics, the government is the payer.

### 5.2.1 Interview Methods

There are different types of qualitative interview methods [47] [46]:

1. *Structured Interview*: The main topic for the interview is decided and a complete interview guide is prepared beforehand.
2. *Unstructured Interview*: This is a very flexible method where the topic is decided, but there is usually no interview guide. This allows the interviewer to improvise suitable questions during the interview.
3. *Semi-structured Interview*: This is a mix between method 1 and 2. The interviewer has an interview guide with some prepared questions, but these questions serve more as guidelines, and allows the interviewer to improvise suitable questions during the interview. This is the most commonly used interview method, and is often called "qualitative interview". [47] [46]

We used semi-structured interview because of several reasons. First, all of our interviewees were physiotherapists and we had some specific questions about their routines directed towards the business model we were developing. However, since they were all working in different clinics the questions had to be adapted towards their field of expertise, and therefore there was room for improvisation. Second, since neither of us are professionals in this field, it would be impossible for us to foresee everything that should be asked about. Last, we wanted to make the interview more like a natural conversation, without locking ourselves to specific questions. This

allowed the conversation to flow more naturally, providing us with some unexpected information, that we did not think about beforehand.

In accordance to the normal structure of an interview [46], we started with an introduction, telling about who we were, what our project was about and what we were there to find out. Then we followed up with some basic questions about the interviewee, like name, age, work and education. In this way, we got to know each other better before the questioning started. We had two different main topics we wanted to discuss; First, how they worked and their relationships with their patients. This was to identify if there was a need and also how the product could fit into their working situation. Second, we had some questions more directed towards the business model; How they got to know about products and how they acquired them. In each topic, we had some defined questions to guide us, but not to limit us. There was room for improvisation at all times. We also edited the interview guide between the interviews based on the experiences we gained.

### 5.2.2 Possible Pitfalls

When doing a qualitative interview there can always occur some unexpected problems or difficulties. We will go through some of the limitations that may have affected our interviews, based on a list of possible pitfalls we found in [47]:

*Artificiality of the interview:* All our interviewees were strangers to us. The interviewee was asked to answer questions and give opinions under time pressure.

*Lack of trust:* Because we did not know the interviewees, them not trusting us could have been an issue. This means that the interviewees may have held back what they think of as sensitive information. This information may have been important information for us, and a possible holdback of this information would make the gathering incomplete.

*Lack of time:* In one of our interview, we had a time-limit. Whether this had a positive or negative effect is hard to say. Time limit can result in an incomplete data gathering, but also lead to the opposite where the in-

interviewee creates opinions under time pressure which can result in more data, but possibly less reliable data. In our case, we do not feel that time constraints resulted in any unreliable data.

*Ambiguity of language:* Sometimes a meaning of a word can be ambiguous. Both the interviewer and the interviewee can misunderstand the meaning. Since our knowledge within this field was limited, it appeared some misunderstandings during the interview. The misunderstandings were discovered when the interviewee read through the interview report, and were fixed at the same time. In this way it did not affect our final report.

### 5.3 Interview Discussion

In this section we will discuss some of the findings we did in our interviews. We will only take into consideration what we find important for our project. Everything is taken from the interviews conducted, in addition to our own opinions and perception of the interviews. For the interested reader, you can find the interview reports in the appendix.

As already mentioned, two of our interviewees were physiotherapists working in government controlled clinics, from now on called public clinics. The third interviewee worked in a private clinic, which she owned with a partner. All of the interviewees had elderly people as a patient group they focused on, but not necessarily their only patient group. The private clinic offered an exercise program where elderly could meet and exercise with other elderly once a week. This is also something that is arranged in the public arena, called "Seniortrim" [6]. The typical feedback from these training groups were that it is nice to get some physical movement and that the social aspects of it is important. The training group in the private clinic costs 60 NOK per session and the one in the public costs 30 NOK per session, allowing most people to afford it. This is two interesting offerings, where we see a potential for the exercise game to be implemented, because this is a arena where they can play more people together as well as getting assistance from a professional.

Two of our interviewees mentioned that they wish to get the patients in for an examination earlier. Most of the patients go to the physiotherapist first when their problem gets serious. Getting them in earlier means a chance for prevention instead of rehabilitation. Everything really depends of the patients background; whether or not it is important for the patients to be able to continue working out everyday activities, or if they just accept the fact that they are getting older and that they are not able to do everything they did before. Typically, people that are used to be very active in the sense of often taking a walk, go skiing during the winter etc., will be more eager to keep a good physical health. For those that are used to get their physical activity from for example gardening, the relation to other type of physical activity may not be present. Thus, it is very important to not look at elderly as one common patient group. They are also different people with different interests.

A normal problem is that elderly are afraid of walking outside their house, making it hard for them to attend their appointments and also other type of activities. Some people are very motivated to improve themselves while others are satisfied with how things are. Usually is one hour at the physiotherapist not enough and it is hard to get the patients to exercise at home, often because of the lack of motivation. It is common to provide the patients with an exercise program that they can perform at home, but there are some problems related to this. First, the patient may not be motivated enough to actually perform the program. Second, it is hard for the physiotherapist to give feedback to make sure that the exercises are done right. And third, there are no one there to make sure that they do not fall and hurt themselves. These problems can also be related to the Kinect based exercise game. One of our interviewee mentioned specifically that one of the problems of motivating the patients is that they do not identify themselves as persons being afraid of falling, so when working with fall prevention it is important to not mention the word "fall".

With regard to our business model we asked all our interviewees where they

typically hear about new products, treatment methods and tools. Different channels were mentioned, like "Fysioterapeuten", an academic magazine for physiotherapists, conferences and from suppliers they already had an established relationship with. Every one of them pointed out how important it is that the product we are trying to sell is proved to work. It is not enough to have an ad in a magazine or newspaper, or show up demonstrating on a conference, if you do not have well documented good effect. If the product has a proved good effect, the staff meeting of the physiotherapists could be an effective arena for promoting the product. Again, she emphasized the importance of the well documented good effect. The threshold for the use of a product should be very low. It must be easy to use and must also ease the workload for the physiotherapist. If it is not better than what the physiotherapist can offer herself, she would not use it. In the public clinics the government pays for everything. Every year, a certain amount of money is given to each clinic. The clinic is then responsible for how they want to spend the money. If a physiotherapist believes in - and wishes to get a new product, the leader will be responsible to consider it and decide if they should buy it. This is different in the private clinics. Here every decisions are made by the owner(s).

The most common way to acquire a product is to buy and own it. Leasing is not that common, but not irrelevant. The private clinic was only one year old, so their economy had not had time to get very stable yet. Because of this vulnerability they were careful about buying expensive new products and they were also sceptic to subscribe on a rental agreement. We represented a fictive scenario where they could get an opportunity of paying only for the use of the game. She was very positive to this possibility. All of the interviewees mentioned that it might be interesting to rent, or even try for free, a product for a certain period of time to check out if it was interesting to buy. One of our interviewees mentioned that for this specific game, it would be necessary to run a pilot project, where some clinics tried the game out for a couple of months. In this way they could test the game and document the effect. It is not enough for the potential buyer to know that this is an EU-funded project and that it seems like a



nice product. The product must be well proved over a longer period of time.

The main goal for the exercise game is to prevent elderly from gradually losing their physical abilities and in that way lose their confidence in doing everyday activities. It is shown that exercise only once a week is not enough [4], this could also one of our interviewees confirm. At the same time, some exercise is better than none, and the physiotherapist who had the group training once a week told that you could actually see improvements after six to seven sessions. For the elderly to be able to improve themselves even more, they will have to exercise more. A plan for the future should therefore be to provide the game for the elderly to use in their own home. It is not natural for us to believe that an older person would go in the store and buy this game themselves. Therefore, it was interesting for us to see if physiotherapist could work as a possible channel where the patient could get this game. In the public clinics it is normal to let patients borrow products, but the products are limited. If the government believed in a product, they could buy some copies that the patients could borrow. In the private clinic it is normal to sell products, like for example special shoe soles, but they do not typically let patients borrow products.

It is not common for physiotherapists to physically go to the store and buy a product. An already established relationship with a supplier is the most common channel where new products are bought. Often after buying a product, the supplier will contact the clinic later with improved or new products. It is quite normal to maintain a relationship with the supplier after a product is bought. This is usually done by the supplier providing the clinic with brochures with news and by offering support if something goes wrong with the product. When the product is bought, it usually gets delivered at the clinic. Physiotherapists have already enough to do as it is, and have not always time to set up and learn a new product. It depends on the product whether they get an introduction or not. It would for instance often be necessary to get an introduction to technical products. When it comes to relationship with the supplier, all the physiotherapists we interviewed stated that the opportunity to come with feedback on the product

was important. The reason for this was that they wanted the product to be customized for their and their patients need.

One of our interview talked about how this game could fit into the Norwegian government's new reform "Samhandlingsreformen". Of course this depends on whether the game is proved to be effective in health improving purposes and in cost. In "Samhandlingsreformen", from now on called "the reform", there is an increased focus on prevention and early intervention. Welfare technology shall support these strategies where possible. In Norway there is a goal to offer everyone in the need of it, a place in care homes . Every 75-year old are offered supervision to promote health and own coping. Every person who is in need of health care services that can be deployed in their own house, should be provided this. The services offered in the private home should be improved. If the services in the private home could be improved to the level where it helps the user being able to live in their own home for three more months, it will be equal to 10 percent of the capacity in care homes. This will depend on better offers outside the clinics. The main focus now should be "hverdagsrehabilitering", from now on called "everyday rehabilitation" in english. This means that a person will get health care first after an evaluation that proves that he or she actually has a need for rehabilitation. The target group are the ones with moderate limitations in functional level. The goal is to postpone their need for extensive help and help them to a more dependent everyday life. "Everyday rehabilitation" has the home care staff as a basis and physio - and ergotherapy as an "engine". If a patient is considered to be in the need of help and support in their own home, they will first meet with a physio -or ergotherapist, who will examine them. The new strategy for the health care system just described is based on the "Fredericia-model". This model is developed in the Danish municipal "Frederica" and is about how physical, social and cognitive capabilities can be maintained and improved, so that functional disabilities in the older generation will be postponed. The experiences from this model have been very positive. 30 percent receive "everyday rehabilitation" instead of ordinary home care. Approximately 45 percent of these end the rehabilitation process with no need of any fur-

ther help, and 40 percent end the rehabilitation process with need of less help than one can assume they would need. [48]

All of the interviewed physiotherapists were positive to Cyberlab's exercise game. At the same time, neither of them could say anything about whether they would use it or not, and if they thought it would be good for elderly, before they had actually tried the game. The game has to ease the workload of the physiotherapist and also offer something better than what they can offer themselves. The ability to customize the program was an aspect that was very important for all of the interviewees. The game should provide the possibility to put together different type of exercises and change the degree of difficulty. To make it possible for elderly to use this kind of game it has to be easy to use and self-explanatory. In addition, the game should give some kind of feedback to the user with instructions on whether they are doing the exercise right or wrong. This can work both as a motivation factor for the user and as a tool for the physiotherapist to keep track on how the patient is doing. The opportunity to not only customize in the sense of the right exercises, but also different themes, should make the game more fun, and more motivating. It is important to remember that elderly today are not that familiar with technology. This game will probably be more relevant when the next generation gets older, especially with regard to the use in private homes. Today, we can assume that the older patient would not go out and buy this game themselves, but rather use it after a recommendation from their physiotherapist. Another issue pointed out was where the game could be used. The different clinics may not have space to have for instance four people playing a video game in one room. Most likely, to be able to take the game seriously, as well as not disturb other patients in the clinic, the game has to be played in an own room. This must be up to each clinic to find a way to work around. An issue implementing this game in a private clinic, might be that they do not have that big customer base. The reason for this is that the patient has to pay for the treatment. At the same time, it could be an interesting tool for them to use to tempt customer to choose them as a clinic. Of course, this might not work, if "all other" clinics offered this game as well. If Cyberlab was to

run a pilot project they should consider whether they would like to run it in the private -or public clinic. If the project was to be run in the private clinic, they will have to pay them to do the work. At the same time they might have a more limited customer base. With this reasoning, it will be easier and more cost efficient to run this kind of project in the public clinics.

From our interviews, we can conclude that physiotherapists are the right customer segment for Cyberlab. Today, it would not be relevant to go straight to the end user, because they are not familiar with this kind of technology. A physiotherapist is a professional who the patient can trust. If a professional say something, we are likely to believe in it. From the interviews conducted, we also found that the best way to get the physiotherapists attention will be to run a pilot project, to test the product and show the game's effect. This should be started in the public sector. It is important that the game can be customized both in the favour of the physiotherapist providing it and the patient using it. The game has to be proved improving the patients physical health as well as their mental health. And at last, it should be fun, motivating and easy to use.

- forandre vanskelighetsgra osv..

## Chapter 6

# Business Model for the Kinect Based Exercise Game

The product Cyberlab is going to develop and sell is a Kinect based exercise game for people over 65 years old. Cyberlab has to find a way to create and deliver the game and capture value from the game. This can be described be the help of a business model, as suggested by Osterwalder [45]. In this chapter we will provide a detailed description of a business model for the exergame. As a framework for this description, we will use Osterwalder's Business Model Ontology, as described in chapter 4. The interviews conducted will lie the foundation for the business model, as well as our own -and previous research.

### 6.1 Product

A product covers all aspects of what a company offers to its customers. The product is composed of value propositions, which are services and values offered to the customer. Cyberlab will develop an exercise game used by physiotherapists in prevention and rehabilitation for elderly. The focus of the exercise game is to improve strength and balance in elderly to prevent fall and injuries. The idea is that this game should have one

general workout version directed towards prevention and one customized version used in rehabilitation.

### **6.1.1 Value Proposition**

Value propositions refer to the value a company offers to a specific customer segment. One of the values this product gives to the customer is an opportunity to offer an alternative, fun and motivation training method. The exercise game could be used as a supplement in training programs or as an exercise motivator. A good motivator is a social aspect, which is highly important for elderly, and that there exist games for different interests. The game could also be used as a tool for physiotherapists to make it easier to customize training programs for their patients. Every patient is different, with individual problems and needs, and it is therefore necessary to provide personalized exercise program for each patient. An important value the product has to serve is that the exercise game can set up training programs and be more motivating than a physiotherapist can. To get a consultation hour at a physiotherapist there is often long waiting lists, so it is important for the physiotherapists to be efficient to serve as many patients as possible, without losing quality in the work done. By using this exercise game it is possible to ease the physiotherapists' workload. The ability of this game is that it can serve more than one player at the same time, which means that a physiotherapist can consult and exercise with more patients in one hour than a physiotherapist can manage without the exercise game. This would be a helpful in the work of shortening the long waiting lists.

## **6.2 Customer Interface**

In this section we will describe how Cyberlab can create value to the customers. Who are the customers, how will they establish contact with them and how will they maintain customer relationship after sales.

### 6.2.1 Customer Segments

In general, a company generates value for a specific customer segment. The target customer for Cyberlab in this business model is physiotherapists working in both public and private clinics. These are entities that have a very close relationship with elderly. In the starting phase we will recommend Cyberlab to focus on the public clinics. A goal for a physiotherapist is to help elderly decrease the risk of falling by using mobility techniques to improve balance and physical strength. One thing to pay attention to is that customers not always are the end user, and that it is important to recognize this difference. A satisfied end user is important for the customer, although they are not the same person. In the beginning we were thinking about elderly as a target customer segment for Cyberlab as they are the end users of the product. After working with and studied this business model we experienced that elderly is not the right target for Cyberlab after all. There are some reasons for that. Elderly today doesn't have a relation to the type of technology Cyberlab is trying to sell, so it would be very difficult to reach out to this customer segment. So how can Cyberlab reach its end users? One solution would be to go through someone elderly can trust and rely on. Elderly, as almost everyone else, relies on authorities, and physiotherapists are an example of that kind of authority.

### 6.2.2 Channels

This subsection about distribution channels describes how Cyberlab should deliver and market their value propositions to the customers. We will describe this by going through the five channel phases.

#### *Awareness:*

We will look into how Cyberlab can raise awareness about the product and how they can get their customers attention. "Fysioterapeuten" is a magazine targeting physiotherapists in Norway. It is published by Norsk Fysioterapeutforbund (NFF) and distributed out to the whole country. "Fy-

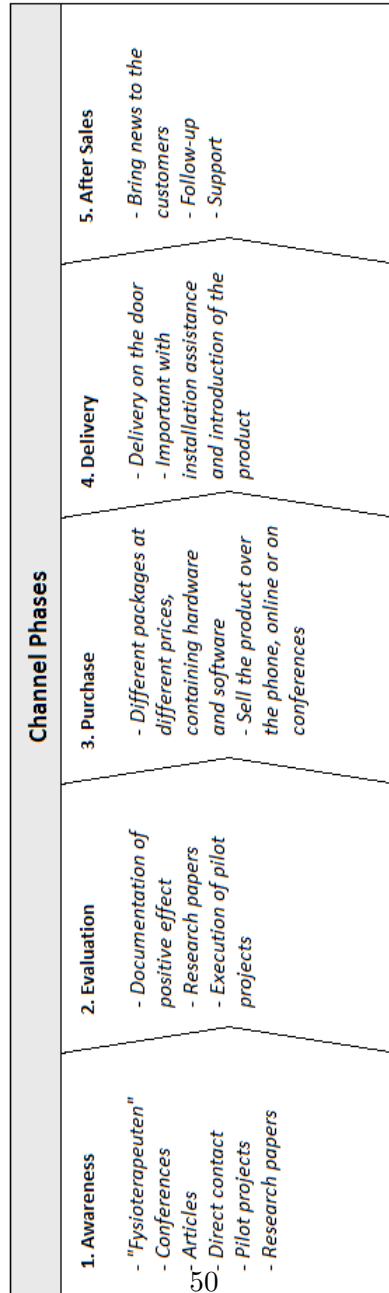


Figure 6.1: The 5 Channel Phases [modified from [45] [44]]



sioterapeuten” contains mostly scientific papers, and the idea is that this magazine shall contribute to evolvement of the physiotherapy profession according to the society and populations need. This magazine is read by 9 000 physiotherapists around the country, and articles printed here are seen as scientific and are therefore taken seriously. If Cyberlab could get an article or ad in “Fysioterapeuten” it will contribute to great exposure of the exercise game. Printing research papers and articles about the exercise game in other credible magazines or newspapers could also get physiotherapists attention. Taking direct contact with target customers is also a possible solution. This could be done on conferences related to the subject of e.g. technology and health or by visiting physiotherapy clinics. Cyberlab could get the opportunity to present the products and show direct interest in establishing a customer relationship. Physiotherapists see it as very relevant to try a product for an amount of time before they decide to buy. By taking direct contact Cyberlab can introduce a pilot project to the customer, which means testing the product for free in e.g. 6 months. Through conferences, magazines or just word of mouth one can also get an impression of which products that are popular right now. The popularity mark might attract some customers. Physiotherapists working at private clinics do not have the same access to customers as public clinics have, so they might chose to buy a popular product to attract new and more customers. (vet ikke om dette passer under her..)

(Nav- hjelpemiddelsentralen)

#### *Evaluation:*

Physiotherapists points out two very important aspects in evaluating a product. These two are; documented effect of the product and own experience by testing the product. If a physiotherapist should even think about trying the product, it is necessary to provide research papers or statistics that shows positive effect in this kind of games. Documentation will give them a security in the choice of buying the product. (Merkelig setning??) Other physiotherapists providing positive feedback after trying the game also contributes to this security. Another part of the evaluation is by letting

physiotherapist be part of pilot projects for a period of time. Then they will have the possibility to test, experience and evaluate the product themselves.

#### *Purchase:*

Most physiotherapists have already established connections with suppliers. Ordering and buying products are usually done online, but it can also be by phone or when interesting products are discovered on conferences. Going to the store to buy products is very unusual. But what will physiotherapists buy from Cyberlab? To play this game you need an Xbox Kinect and the exercise game. It is unreasonable to think that a physiotherapist already owns an Xbox Kinect, so the best strategy for Cyberlab would be to sell packages containing both hardware and software. Packages should include various agreements with appropriate pricing. Some examples are selling the package with or without installation assistance and introduction to the product, or by selling a license agreement and "give away" the package for free.

#### *Delivery:*

When buying a new product, especially technical products, there is a need for introduction to the product and maybe also installation assistance. Feedback from interviews with physiotherapists shows the huge importance of start-up help. With much to do at work already, physiotherapists do not have time to pick up deliveries at the postal office, or to setup and learn a new product all by themselves. Buying, receiving, installing and learning should not be difficult or time consuming. The product should be delivered at the door, by someone who can install the product and teach the physiotherapists how to use it.

#### *After sales:*

When taking a new product in to use, it is important for physiotherapist to have the possibility to come with feedback. Therefore, Cyberlab should have some kind of support that can take these feedbacks into consideration. Feedbacks can be comments on direct errors or directions on how to make the exercise game more suitable for its use. Cyberlab should follow their

customer in the process of learning, and they should inform them of new features and improvements.

### **6.2.3 Customer Relationships**

Customer relationship is an important part of the customer experience, and it describes what kind of relationship the company establishes with the customers. Support, follow-up and feedback handling are some aspects in establishing customer relationship. Cyberlab has to be available when the customers has problems and needs help. When using a new product one may discover errors or find the product not suitable for its use, so many physiotherapists have an eager to provide feedback on this. Cyberlab should handle these feedbacks, fix errors as soon as possible and take comments on improvements into consideration. Using feedback to make a better product shows customers that Cyberlab takes their comments seriously. In addition, the customers will hopefully get a more suitable product. The maintenance of a direct and personal contact with the customer shows interest in the use and the experience of the product. All this can contribute to a good customer relationship. Cyberlab should also give their customers a heads ups on updates, new features or products.

## **6.3 Infrastructure Management**

This section is about how Cyberlab creates value. What resources needed and what activities that have to be preformed are described here, as well as if they will get them in-house or from a partner.

### **6.3.1 Key Resources**

In this section we will describe all the resources needed to make the business model work. The resources are divided into 4 different types, described in table 6.1.

Type of Resource	Resource
<i>Intellectual</i>	Insight and experience with fall problematic in elderly
	Programming skills
	Creativity
<i>Physical</i>	Premises
	Equipments, i.e. desks and computers
	Microsoft Xbox HW
	Working Environment
	Internet Connections
<i>Human</i>	System Developers, i.e. programmers and interaction designers
	Administration, i.e. marketers, customer related tasks
	Support Person(s)
<i>Financial</i>	The European Union

Table 6.1: Different types of resources

### *Intellectual*

The developers needs insight and knowledge about different exercises that will strengthen muscles and improve balance in elderly. A thorough background study and research have to be conducted to acquire this knowledge. When they have enough knowledge to form the foundation of an exercise program, they can start to get creative. Creativity is needed to make the game entertaining and easy to understand and conduct. In addition, good programming competencies is needed to develop the game. To make it as cost-efficient as possible, an experienced team should be put together.

### *Physical*

To be able to conduct this project, the team need premises with everything that comes with it, like desks, chairs, computer, internet connection, light etc. Cyberlab is an already established business, so we can assume they already have these premises and equipments established. For this project, they will need specific hardware. The hardware consists of Xbox 360 console and Kinect sensor. In addition an environment where the game can be

developed is needed.

#### *Human*

Programming skills and creativity are already described above as intellectual resources. So system developers and interaction designers are needed. An administration is needed for marketing, customer related tasks and resource management. When the game is finished it needs to be operated and maintained. These tasks can be done by one or more of the system developers.

#### *Finance*

This project is financed by the European Union.

### **6.3.2 Key Activities**

The game can be described as a Value Chain, which means transforming inputs to a final product. From the knowledge and experience they have acquired the company wants to make a product as good and price-competitive so that their customers would choose their product instead of a product with similar value. A description of the different stages in the value chain is depicted in figure 6.3.2. In some way it can also be thought of as kind of a Value Shop, because they are in some way solving a problem for a specific customer segment. To do this, they will work in an iterative way, where they will have to test and evaluate the game during the development process. The users have to be involved during the development. Activities that need to be done include research, development, testing, maintenance and updates, support, marketing and administrative tasks.

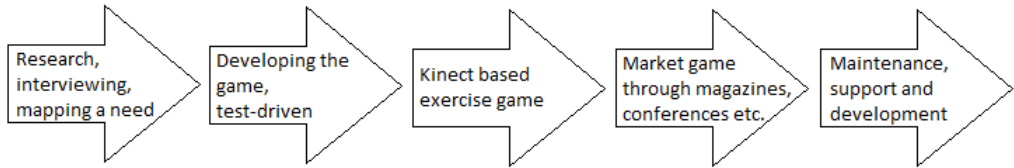


Figure 6.2: Value chain for the Kinect based exercise game [modified from [44]]

### 6.3.3 Key Partnerships

The main partner in this project is the partnership with Microsoft Xbox. There are several reasons for this. First of all, they need the approval that they are allowed to develop games for their video game console, and second, they need Microsoft Xbox' hardware and development environment. They will also have to form an agreement with Microsoft Xbox on how they can sell the product.

As mentioned in the introduction, this project is a collaboration between many different entities, where Norut, a national research group, is one of them. Their job in this project is to provide Cyberlab with research.

Physiotherapists are their customer segment, but they can also serve as a partner. Becoming partners with different clinics, will make the marketing and selling easier, because then the actual customer believes in it.

If professionals, physiotherapists believe in this, then the government should believe in it. Getting this game into a medical program financed by the government will make this game very credible for the end user. The government could then provide the game to hospitals, care centers, physiotherapy clinics, training groups, and for special cases, when the elderly for example need the game in their own house.

This game can fit well into "Samhandlingsreformen", described in chapter 5. We see this game's potential as a tool for "everyday rehabilitation" (See chapter 5). This requires a collaboration between Cyberlab, physiotherapists and the government. Becoming partners with the Norwegian government will first require that the physiotherapists believe in it, so they will first have to join the team. But it is not a requirement that physiotherapists become a partner. However, some kind of collaboration has to be established with the physiotherapists, since they serve as the professionals. This will typically happen in the research, - development -and testing phase.

Having the Norwegian government as a partner will solve some of the financial issues. Most hospitals, physiotherapy clinics and training groups are managed and financed by the government. With them believing in the game and including it as a helping tool that will prolong and improve elderly's life it will be easier to hit the target users.

## **6.4 Financial Aspects**

In this section all the outgoing and incoming money will be described. All the previous blocks described are contributing to a cost or an income. We will try to provide an as realistic and detailed estimate of both costs and income. For convenience we will only take the Norwegian market into account. (Si noe om våre forutsetninger for å kunne beskrive kostnader og inntekter)

### **6.4.1 Revenue Streams**

The revenue stream describes how the company can earn money, and for Cyberlab this involves selling a product package consisting of the Microsoft Kinect sensor and the exercise game. There are various ways to sell this product, and we will present two solutions.

Before pricing the product it is necessary to observe today's market with possible target customers, prices on existing games and physiotherapy tools,

and the potential demand for this product. Demand will depend on the documentation of the product and popularity within the physiotherapy community, as well as the product price. Calculating an exact demand for this product is almost impossible due to the lack of existing games in the same genre for this purpose, and also since the game Cyberlab are going to sell do not exist yet. In this section we will assume that the exercise game has been developed, tested and that it has received a great amount of positive feedback. Physiotherapists in Trondheim has started to use the exercise game, and it is being appreciated at the same level as other tool used at the clinic.

Pricing this product depend on existing games and tools, and development cost in hope of achieving a non-negative profit for Cyberlab. We can start by looking at existing products. Cyberlab's exercise game falls under two definitions, a video game and a tool used in physiotherapy for training and rehabilitation. The video game market today exist of a huge amount of various games. They are mostly in affordable price range, where e.g. Nintendo Wii games are priced between 99 - 249 NOK and Xbox Kinect games are priced between 199 - 499. Physiotherapy tools has more variation in price range as the definition of this tools are quite wide. Prices can vary from a fixed price of 75 NOK for a stretch pulley (<http://www.ilenfysioterapi.no/priser/>) to 11 000 NOK per month for shockwave therapy leasing (see appendix "Intervju med Nina"). As we will present later, a package consisting of hardware and and Cyberlabs' exercise game will have a much higher price than other video games on the market. Trying to sell the exercise game for more than the already existing ones will be difficult, so it is therefore highly important for Cyberlab to promote their product as more than just a regular game to justify the price difference. This should be done by emphasizing the products value propositions, which relates the product more to physiotherapy equipment than "just" a video game.

Cyberlab's market potential, which is also important for setting a suitable price, can be roughly calculated by looking at the number of public and private physiotherapy clinics with support from the government, from



now on referred to as physiotherapy clinics or just clinics. We looked at four municipalities in Norway, Oslo, Trondheim, Fredrikstad and Tønsberg, where we for each found the number of clinics and compared that number to the population in each municipality. The average ratio we got describe inhabitants per clinic in Norway. Multiplying this with the total population in Norway gave us an approximation of physiotherapy clinics suitable for Cyberlab's customer segment. Our calculation (see Appendix blabla for details) shows that Cyberlab has a possible market in approximately 1 200 physiotherapy clinics in Norway. It should be mentioned that the market potential can become bigger if Cyberlab takes private physiotherapy clinics without any economic support from the government into consideration. These clinics has shown interest in this product, so they can become potential target customers, but they have other decision making processes, a different economy and often a more limited customer base than public physiotherapy clinics. After some time, when the product has been on the market for a while, physiotherapists has got the time to work with the product and elderly has used the exercise game with assistance in a safe environment, it might be time for Cyberlab to think about expanding their market and start selling the product to end users, the elderly. This will increase the market potential significantly. The package price for the end user has to become drastically lower, and with a greater market potential Cyberlab will have the opportunity to sell their products to a lower and more affordable price for an elderly. Private clinics and elderly will not be taken into consideration when discussing Cyberlab's revenue stream.

It will be natural to assume that Cyberlab, after documenting positive health effect on their product, will experience interest and demand for their exercise game in Trondheim. Because the product is being developed in Trondheim with close relationship to the hospital, scientist and physiotherapists, the word of the game will be spread in sectors related to Cyberlab's target customer segment. A reasonable place to start marketing and selling the product would therefore be in Trondheim. Cyberlab has as mentioned worked with some of the clinics, they would have the possibility to follow the startup phases closely, and they can respond quickly to re-

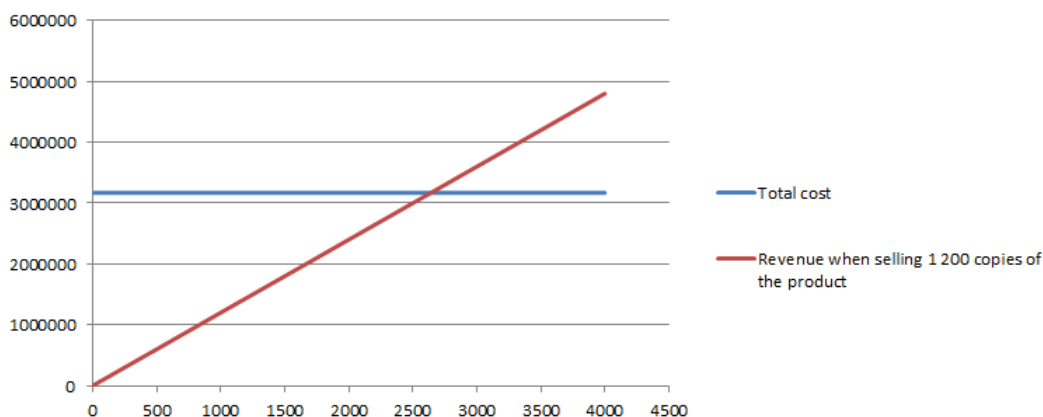


Figure 6.3: The lowest possible package price Cyberlab can have, provided that they sell the max amount of copies - 1 200 units, is 2650 NOK

quested changes or when eventual errors occur. If Cyberlab can establish a customer base in Trondheim consisting of e.g. 10 physiotherapy clinics and the feedback from these clinics are positive, the game's reputation might spread to other parts of the country. Selling the product to 10 physiotherapy clinics to a suitable price will not provide Cyberlab with any profit, so it's absolutely necessary to reach out to other cities and municipalities. (SI noe om at ordet sprer seg lett? Si noe om vanskeligheter ved å spre nye produkter?)

We will now present two different solution for how Cyberlab can sell their product, with suitable prices for each solution.

#### *Solution 1 - Fixed price*

The first solution is to sell the product as a package consisting of both

software and hardware to a fixed price. Included in this package is delivery, installation assistance, and introduction to the product. We believe it is necessary to sell the product included in a total package for several reasons. Assuming that physiotherapy clinics already possesses needed equipment as a Kinect sensor, projector or screens big enough is unreasonable to assume. Neither is it reasonable to believe that physiotherapists will buy software from Cyberlab and then walk to the store to buy rest of the equipment. In the package we have also included installation help and introduction, which we have experience as important for physiotherapists. For this type of technology equipment it is useful to give an introduction to the product. We can not expect that physiotherapists has the time to teach themselves how the products work. This could result in physiotherapists buying the product and ending up never using it because of the lack of information.

The package price will cover wages for the hours of installation and introduction, hardware, and other cost connected to development, investment and marketing of the product. For Cyberlab, total cost is approximately 3 170 000 NOK (see Appendix KinesRegneark). This number does not include purchase of hardware in the packages or wages for installation and introduction. In this section we will not take wages for installation and introduction into account, as it is very difficult for us to calculate all costs connected to this. We will now look at different price proposals. If we assume that Cyberlab has the possibility to sell their product to all of the 1 200 physiotherapy clinics in Norway, they could have a price as low as 2 650 NOK, see Figure 6.4.1, without gaining negative profit. However, it is very risky, almost unreasonable, to assume that Cyberlab could reach out to all target customers. Figure 6.4.1 shows three income lines related to three different prices. With a price of 6 000 NOK Cyberlab needs to sell at least 529 units to achieve non-negative profit, but with a price of 10 000 NOK they only has to sell 317 units. How many units Cyberlab has potential to sell and what price customers are willing to pay depends on demand, which we have mentioned is difficult to measure. A maybe more reasonable sales number would be to cover a third of the possible market share, which is about 400 units. (Si noe om: dette pga av usikkerhet rundt spillet, det

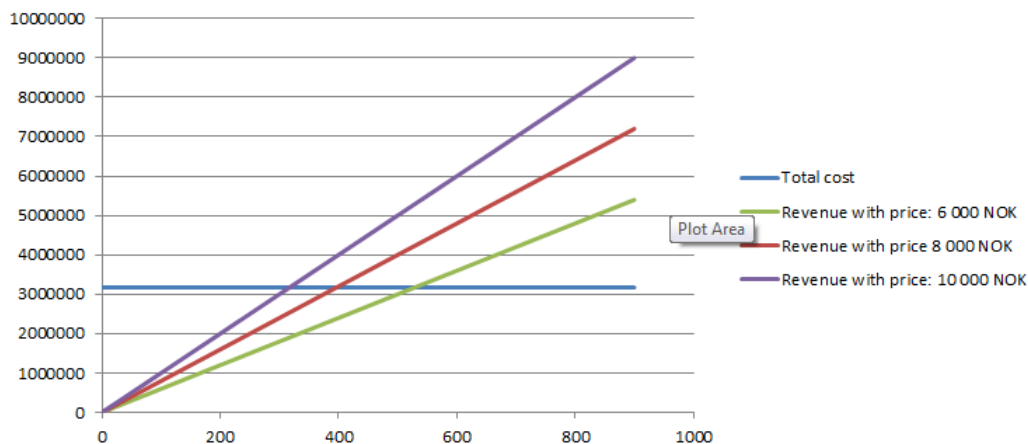


Figure 6.4: Total cost and three revenue lines related to three price examples; 6 000 NOK per unit, 8 000 NOK per unit and 10 000 NOK per unit, shows minimum number of units Cyberlab has to sell to achieve a non-negative profit

er nytt. Ikke alle klinikker har behov. Konservativ gjeng. Ingen lignende teknologi. Ikke så kjent med teknologi). Pricing these units at 8 000 NOK will give Cyberlab some profit. (Hvordan skal jeg begrunne hvilken pris jeg bør ta? Kanskje se på noen andre utstyr fysioterapeuter bruker og sammenligne pris). (Se på kommunens budsjett til fysioterapeuter). However, the final price for the customer will be significantly higher to cover the hardware; Kinect sensor, projector and a screen, which costs approximately 5 140 NOK.

#### *Solution 2 - License agreement*

The other solution is to sell the same package as in the first solution, where the package here is implemented in a license agreement. Customers will

pay a low start price for the package, and a certain amount of money for each time they use the product. This low start price will not alone cover all of Cyberlab's total costs, even if they sell to all their potential customers, so it depends on customers using the product. As in the first solution, Installation and introduction is also here included in the package, but it will not be taken into consideration when we describe package price proposals.

We will start by making an estimation of how much this exercise game potentially will be used. Usually, a physiotherapist works approximately 8 hours a day, which includes 30 minutes lunch. Not every patient visiting the physiotherapy clinic during a regular day falls under the category "elderly", and not every elderly visiting the clinic can, has the need or wants to use this exercise game. We roughly estimate that the exercise game will be used approximately 2 hours a day. A physiotherapist works 47 weeks a year, assuming they have 5 weeks of vacation, and this adds up to 470 hours a year where the exercise game will be used.

A proposal for a suitable price for this license agreement is a startup price of 2 000 NOK for the package and a price of 50 NOK (Begrunne denne prisen med total pris for en time, hvor mye de sparer på effektivitet/haflere i samme time) for each hour physiotherapists use the exercise game. During a year this will add up to 25 500 NOK. In the first solution, the price for hardware was added on top of this total price, but here this is included in the license agreement. Therefore, since Cyberlab's total costs is measured without consideration of the hardware price we subtract this price from the estimated revenue. So, for each customer purchasing this license agreement, Cyberlab will have an estimated revenue stream of approximately 20 000 NOK. We observe that Cyberlab in this case only need to sell approximately 160 units to make a profit. The income increases much more in this license agreement example than in the fixed price example. Where we in the first example showed that Cyberlab barely achieved profit by selling 400 units, they can with this license agreement sell the same amount of units to a profit of 4 830 000 NOK (See Appendix blabla).

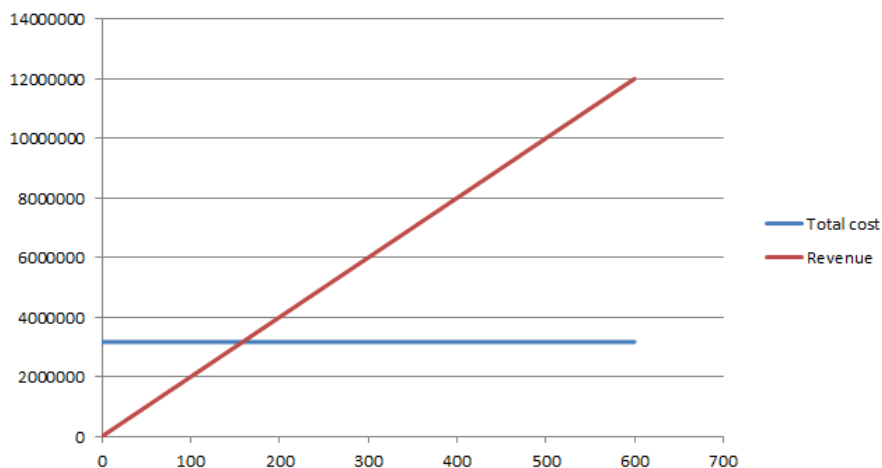


Figure 6.5: Profit when using license agreement(blabla

We can conclude that selling a license agreement is the best solution for Cyberlab. The possibility of gaining a non-negative profit is higher, and the profit has the potential of becoming much higher than with a fixed price solution. For the customers point of view a license agreement will appear more appealing than a fixed package price because of the low startup price (trekke inn noe psykologisk rundt kjøpsprosesser). Customers observe that the product price is higher than other existing video games on the market, but they also know what value propositions this exercise game holds, which justify the price difference. They also have information about prices on equipment used at physiotherapy clinics, which makes Cyberlab's license agreement affordable. Customers also have other reasons for why they prefer this solution. One example is "Ilen Fysioterapi og Idrett", a private physiotherapy clinic with no economic support from the government, which sees a security in the possibility of buying the product with a

license agreement (Se Appendix “intervju med Nina”). The startup price is manageable, and they can control additional costs themselves after how much they want to use the equipment. Private physiotherapists might not have the same financial resources as local institutes, so the idea of paying according to how much they use the product is appealing.

### 6.4.2 Cost Structure

Cost structure takes into account all elements that generates costs specific to this game. Cyberlab is an already established business and we can therefore assume that there are not any additional costs associated with premises and some of the ”regular” equipments (e.g. desks, chairs, computers etc.). First we distinguish between fixed and variable costs, investment costs and ongoing costs. Variable costs are associated with demand. In this case it is hard to say anything about the demand. Therefore we do not have sufficient knowledge to say anything about the variable costs. For this game, the variable costs will be salaries associated with support, maintenance, marketing and sales. However, since we are dealing with a market which is very hard to analyse with respect to demand, we will make a prediction on how much work is required for each of this tasks, for each year of the game’s lifetime. Thus, in our analysis, all the costs will look like fixed costs.

In this case fixed costs are associated with salaries to all the involved workers on this project. The reason why we define these as fixed costs is because the employers are assigned this project for a fixed period of time (this especially accounts for the employers in the developing-phase, but we will also assume this for all other involved employers). This includes project manager, developers, interaction designers, support, marketers and salesperson. There are additional costs associated to having an employee, explained shortly. The investment costs associated to this project is the hardware and software needed to develop the game. This includes specific hardware and a Software Development Kit (SDK) for the sensor. The commercial price for the Kinect sensor is 1790 NOK [49], and the SDK for the sensor is free. In addition they should have a screen for testing purposes.

The screen should be of significant size, so we suggest they invest in a projector and 90" projector screen, which should be sufficient for its purpose. We found that the cost of an average screen lies around 895 NOK and 2449 NOK for a projector [50] [51].

Cyberlab has estimated that for the developing of this game they need a Full Time Equivalent (FTE) = 1.0, meaning that the workload is equivalent to one person working full time for a year. We assume that this will cover development, testing and administrative tasks. In addition to that, Norut who provides research has also assigned a FTE = 1.0. How many people assigned to the project is unknown and also irrelevant for the cost prediction, (assuming each employee has the same salary). We have done a rough estimate on how much the cost of having FTE = 1 in the private sector is. From [52] we found statistics of salary in the private sector in Norway. Assuming that the "average" employer on this project graduated in the end of the 90's, we look at an average gross salary of approximately 730 000 NOK a year. From this we can calculate the average cost of a FTE = 1.0, based on [53], see Table 6.2, which will be 1 003 349 NOK. We did the same calculations for researchers in the government controlled sector and for marketers in the private sector. They both ended up on a cost of 715 577. See appendix for calculations.

We will now look at some ongoing costs on a per year basis. The game has to be operated on a server. This can be on a local server located in Cyberlab's office, a server located at one of the physiotherapy clinics or on a cloud hosted server. The size of a Kinect game varies a lot, depending on quality, colors, how many levels etc. What we do know is that the game itself will be of fixed size. The dynamic part of the space needed on the server is associated with how many customer profiles it needs to store. This is a hard task to answer, but we assume that the user profiles do not take up that much space, and that Cyberlab can make it with a small server with fixed space. At this stage it is also hard to make an exact assumption on how big the game will become, but from already existing Kinect games,



1	Gross Salary		730 000 NOK
2	Holiday Pay	12.1% of 1	88 330 NOK
3	Employee Fee	14.1% of 1+2	115 385 NOK
4	Pension Costs	8.0 % of 1	58 400 NOK
5	Employee Fee of Pension Costs	14.1% of 4	8 234 NOK
6	Insurance		2 000 NOK
7	Mobile and Internet		1 000 NOK
	<b>SUM</b>		<b>1 003 349 NOK</b>

Table 6.2: The cost of FTE = 1 in the private sector (for Cyberlab

we can assume that the size will not be bigger than 10 GB. From Gogrid Servers [54] we found a small server with storage space of 25 GB. We believe this will be sufficient for Cyberspace's purpose. There is also reasonable to believe that Cyberlab has some space available on their servers. However, if they would have to rent this kind of server space, we are looking at an annual price of \$181.25 which is roughly 1 087 NOK (with a currency of \$1 = 6 NOK).

With new software and technology there will always be some errors and bugs after the product or service is delivered. We can assume that the first six months are the most critical months, and will require a FTE = 1/5. The remaining life time will only need support for some minor problems that might appear (e.g. customer service, operating the server). We assume this period will require a FTE = 1/10. This is very hard predictable numbers, because this may vary over time. However, our predicted numbers are reasonable as "average" numbers, taking unexpected events into account. With the rapid evolution of technology, we believe that Cyberlab can offer this game for five years after its release. After, or even during, these years, they will probably have to start making new versions, even for new types of technology. (FINN KILDE PÅ DETTE) We do not take the development of new versions into account in our calculation, and we will set the lifetime of this game to be 5 years.

Marketing is one of the most important part of selling a product or service. This is especially important in the first year of the games life time. The cost of marketing is difficult to analyse because it depends on how long it will take to acquire customers. A new product or services need to acquire customers quickly, and therefore more resources need to be put into the marketing tasks. We can look at the exercise game as a niche product that is targeting a specific customer segment. Thus, the marketing task needs to be customized for this specific customer segment. When a critical mass (the number of customers needed to survive economically in the market) is reached the market will somehow be self-supported [55]. We believe that after this critical phase, the marketing costs will be rather low and close to constant. We assume that the first year right before, during and after the release, the marketing task will contribute to a  $FTE = 1/2$ . After being on the market for one year, the customer base should have reached critical mass. We believe that in this type of community (the physiotherapist community), words spread fast. If someone starts using a product that is proven good, it will soon appear in magazines and by word of mouth, resulting in the interest from more. Even after critical mass is reached, there will still be some marketing related tasks (e.g. keep up with the market, look for new customer segments), so we suggest that the marketing tasks should contribute to a  $FTE = 1/5$  after the first year. With this low workload, Cyberlab should consider to hire a marketing consultant in stead of having a permanent employee. (Mulig de har en egne markeds- og salgsansatte) FINNE NOEN TALL PÅ Å LEIE MARKEDSFORER.

As mentioned we suggest that Cyberlab should run pilot projects to document the effect of the game. This will also serve as a very effective way of marketing the game. We suggest that the pilot project should be carried out in two different clinics in Trondheim for convenience, and that it should run for six month. The effect should be documented during the project and after. This documentation should be published in scientific articles and distributed to physiotherapists. (Lurer på om også offentlige klinikker må ha penger for dette? det er vel de som skal dokumentere effekt osv. Vil jo gi

de ekstra arbeid.). We assume that the development of the game will take about six months, so the first year will contain the development phase and the pilot project. The pilot project will most likely provide Cyberlab with valuable feedback on the game, where they can both test the usability in a real environment as well as discover bugs and errors. This will require close monitoring from Cyberlab, so we suggest that this will require a FTE =  $1/5$  for this six months (This equals FTE =  $1/10$  seen in a whole year). Spending six months on the initial developing and six months on the pilot project, means that Cyberlab is looking at a whole year without revenue.

The exergame will be sold with as a package with all the hardware needed to the customer. This makes it more convenient for the customer and easier to sell. It is not reasonable to believe that Cyberlab will earn money on the hardware. They will need to make an agreement with Microsoft to buy the Kinect sensor and sell it further to the same price. The same applies for projector, screens, and Windows machines. This means that Cyberlab will need to have the liquidity to be able to buy a set of hardware that they later will sell to their customers. We suggest that they should have some hardware in stock for quick delivery. This means that we need to anticipate how many customers will buy the game every year. We believe that it is not unrealistic to look at the S-curve for how much of the market they will take year for year. In the first year they will only take a small part of the market, but as soon as the game gets attention from the rest of the market, it will spin of pretty fast, before it will slow down again when most of the market is saturated. BLIR DET FEIL Å TENKE SLIK?

From the interviews conducted we found that it was desirable with installation and introductory help when buying a technical equipment. This is a complicated task for Cyberlab when we look at every physiotherapy clinic as their customer segment. It is not realistic that one representative from Cyberlab will travel to the other side of the country as soon as an clinic order the game. In the first year, we suggest that Cyberlab focus on delivering the game to clinics in Trondheim. Selling the game in only Trondheim to an acceptable price, will not make profit. We believe that

Cyberlab is looking at some years before they will make profit. The physiotherapy community is small and they have a lot of similarities. By the time this game has become well-known in Trondheim, the game has probably got attention from clinics in other cities as well. We suggest that Cyberlab hire some of the physiotherapists that are already using the game to present it on conferences and learn other physiotherapist how to use it. In this way, the game will be both more believable to other physiotherapists, as well as Cyberlab do not need to do the hazel with travel around promoting their game. There is still some costs associated to this. HER TRENGER VI LITT TILBAKEMELDING..

Taking all the described costs into account, the project with six years of lifetime (including development and the pilot project) will have a total cost of 3 168 773 NOK. See appendix for calculation (Ikke der ennå).

# Chapter 7

## Miscellaneous

### 7.1 Security aspects

There are some issues regarding the security of personal information associated to this game. When a clinic starts using this game, they will make a user profile for each patient. This profile will presumably contain name, age, physical and mental conditions, diagnosis, the patients exercise program and the history of games played. It might also contain other type of information, like home address, phone number, relatives etc. The purpose of this record is for the physiotherapist to easily keep track of the patients improvement and to be able to adjust a program in an efficient way. The long time goals of this game is that eventually patients can start using this game at home as a supplement to their regular treatment. It will then be possible for the physiotherapist treating these patient, to log on to and look at the patient's profile at any time. This profile will probably be a webpage where the patient (or user) and the physiotherapist treating this patient can log in. This webpage will be retrieved from a remote server hosted by either Cyberlab or in the cloud. Anything on the web always face some security issues. It is important to know that the right person with permission is getting access to the information. This require proper login and authentication.

Something that we also can ask ourselves is how sensitive the information contained on the web page really is. Of course, no one would like anyone to read their health history. Except from that you can really get the other information anywhere else on the web. SSL should be used to secure the communication between the server and the client.

One way of not linking the actual patient to the record, is to use patient numbers. This requires the physiotherapists to have their own database with patient names linked to patient numbers. We assume they already have this. However, this will make it more inconvenient for the physiotherapists to use, because they will have to look up every patient number and link it to the name themselves. It is very important for the physiotherapists that the information will be given to them in an easy and efficient way, so this solution will not hold.

What harm will possible information leakage do? First, if an attacker get access to the data and reads it, they can get some interesting information. For example they can read a medical description that says that the patient is in a wheelchair. If in addition they can get the address from the patients profile, this house can be a target for a robbery. ...Ikke ferdig.. (Første utkast)

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# Appendix

## Apendix A - Intervju 22/10/12 kl. 1300

*-Intervjuobjekt:*

Jorunn Helbostad, utdannet ved Universitetet Bergen, hovedfag og doktorgrad i fysioterapi. Jobber som forsker.

*-Av deres pasienter fra 65 år og oppover, hva er problemet? Har dere pasienter som er hos dere for opptrening etter for eksempel en skade (rehabilitering)? Har dere pasienter som er hos dere for generell trening fordi de ønsker å styrke kroppen?*

Det finnes private og kommunale fysikalske klinikker. Disse har avtale med trygdesystemet. For å få time hos fysioterapeut må man ha rekvisisjon. Pasienten kommer i kontakt med fysioterapeuter gjerne fordi de har et definert problem. Det hender for eksempel hjemmesykepleiere tar kontakt på vegne av en pasient de pleier. Det er sjeldent den eldre tar kontakt selv.

*-Hvordan er oppfølgingen under behandlingen? Hvordan er oppfølgingen etter behandlingen? Pleier dere å gi pasienten program som de må trene på hjemme mellom hver time?*

Ofte er det ikke nok å være hos fysioterapeuten 1-2 ganger i uka. Det er en utfordring å få de til å gjøre noe hjemme. De eldre ønsker gjerne å "bli friske", de er ikke veldig motiverte til å trene hjemme på egenhånd. Vanlig å oppfordre til å bevege seg mer hjemme, enten ved å gi en form for treningsprogram eller si noe som "husk å være fysisk aktiv". Dette kan

være at fysioterapeuten skriver en lapp med strekmennesker som forklarer øvelser, eller et dataprogram hvor man kan sette sammen et program med øvelser og printe ut til pasienten, eller noen sier bare noe så generelt som at de må ut å bevege seg.

*-Opplever dere at det er pasienter som har problemer med å komme seg til behandling? Hender det dere må dra på hjemmebesøk?*

Nei, de som er dårlige til beins, får dekket drosjetransport til behandlingen. Men det er klart at mange vegrer seg for å gå ut. Det er også mange som vegrer seg for å bevege seg innendørs.

*-Er det noen som uttrykker at de ønsker hyppigere trening?*

Sjudent. De vil vel gjerne få en slags "pille/medisin" og bare bli frisk og rask.

*-Er det mange som uttrykker ensomhet/ulykkelighet?*

Det er veldig få som identifiserer seg selv som en person som er redd for å falle. I prosjekter hvor det har blitt foreslått forskjellige tiltak blir man ofte møtt med svar som "Det høres ut som en fin ting. Gi det til noen som trenger det". Det er mange som ikke sier ifra at de har falt. Å forebygge noe som "ikke har skjedd" er vanskelig. Dersom man jobber med fallforebygging, bør man ikke nevne ordet "fall". Det bør fokuseres mer på positive ting, som å styrke kropp for å kunne leke med barnebarna, gå på kafe osv.

Det er opprettet noen treningsgrupper i Trondheim som er ment å forebygge fall. Men de reklamerer ikke med dette. I stedet reklamerer de med feks: "Vil du greie mer enn før...?".

*-Hvordan får dere høre om nye behandlingsmetoder, hjelpemidler, vektøy osv?*

Vi har "Fysioterapauten" som er et tidsskrift for fysioterapauter. Her blir stilen holdt ganske ren. Ellers er det jo også artikler i blant annet aviser og magasiner. Man drar på kurs og konferanser, men da gjerne innenfor

et bestemt fagområde. Et bra sted å lansere nye produkter er kanskje på konferansene eller i "Fysioterapauten". Det er ofte snakk om etterutdanningskurs, ikke så mye om nye produkter.

*-Hva er interessen for nye ting?*

Her er det snakk om en ganske konservativ gruppe. Man vil veldig gjerne ha en dokumentasjon på at det fungerer. Produktet bør ha en lav brukerterskel. Hvor lett er det å bruke? Det må lette arbeidsmengden eller forbedre arbeidet for at det skal være interessant å ta i bruk. Man må også finne ut hvem som skal betale dette. Helsesektoren? Kommunen? Man må gjerne "stå for produktet" og klare å få fram at det er verdt å betale for. Pris på produktet har nok mye å si!

*-Må nye produkter være godkjent for medisinsk bruk?*

Et spill som dette havner litt i en gråson. Det finnes lover og regler, men jeg tror ikke man trenger medisinsk godkjenning for å ta i bruk dette spillet.

*-Hvordan foregår en kjøpsprosess hos dere?*

Det vanligste er nok at man kjøper for å eie selv. Det er interessant å leie eller prøve produktet en viss tid for å være sikker på at det er et godt kjøp. Ofte skjer det at man kjøper inn et produkt, men så blir det gjerne liggende fordi man ikke tar seg tid til å lære det. Her kreves det opplæring! Det som også gjerne skjer er at en ivrig person tar initiativ til å kjøpe et nytt produkt og lærer seg hvordan det skal brukes, for så å kanskje slutte. De gjenværende har ikke lært seg å bruke produktet, og så blir det liggende.

*-Hender det at dere kjøper inn produkter for så å selge dem videre til kundene deres?*

Fysioterapautene kunne jo kjøpt spillet og eventuelt en lisens med på kjøpet, men jeg tror kanskje at eldre vil vegre seg for å kjøpe. Hvis kommunen så på det her som noe bra, så kunne kommunen ha kjøpt inn og lånt ut til eldre.

Det er alltid en utfordringen med ny teknologi - hvem skal betale? Prosjekter har strandet fordi man ikke blir enige om hvem som skal betale.

På fylkeskommunalt nivå har man hjelpemiddelsentralen. Hjelpemidler som kan lette hverdagen til folk kan bli kjøpt inn av hjelpemiddelsentralen og leid ut videre. Jeg er ikke helt sikker på hva som er grensen mellom trening og ”fungere bedre i hverdagen”

*-Hva slags forhold har dere til leverandørene deres?*

På avansert utstyr kan man kjøpe serviceavtale. Men det er gjerne ingen som kjøper fordi det er for dyrt. Det er behov for oppgraderinger og oppfølging. Man ønsker gjerne tilpassede programmer, det vil gi større lyst til å prøve/bruke produktet. Sånn sett foretrekker jeg å samarbeide med små bedrifter, for da kan det være lettere.

*-Hva tenker dere om å bruke det videospillet som vi har beskrevet som en alternativ og annerledes behandlingsmetode*

*-for generell trening?*

*-tilpasset rehabilitering?*

For å kunne si noe om dette, ville jeg sett og prøvd spillet. For at det skulle vært interessant måtte det kunne lette arbeidsdagen min som fysioterapeut og gi meg muligheten til å tilby bedre hjelp til pasientene. Dersom jeg ikke syns øvelsene er relevante, ville jeg ikke brukt spillet. Spillet må være bedre enn det jeg kan tilby selv og øvelsene må kunne tilpasses. Når jeg har en pasient vil jeg finne ut hva som er pasientens problem ved å undersøke pasienten. Ut i fra problemet jeg finner, vil jeg legge opp et program ut ifra hver enkelt pasient. Innhold og vanskelighetsgrad må være tilpasset behovet.

*-Hva slags verdi tror du er bevegelsesstyrkende videospill kunne gitt til en bruker?*

Det kan oppleves både som spennende og som en barriere for pasienten. Mange eldre opplever teknologi som en barriere. Spillet må fenge pasienten. Spillet bør ha mulighet for individuell tilpasning. For å redusere fall bør øvelsen inneholde balanse og styrke og det må være mulig å tilpasse vanskelighetsgrad slik at det kan bli vanskeligere. Med øvelser med fokus på



styrke og balanse er det bevist at man kan redusere fall med 20-60 prosent. Det teknologi kan bidra til er å gjøre det mer underholdende og motiverende. Tilbakemelding er en viktig motivasjonsfaktor. Dersom man for eksempel får tilbakemelding på at øvelsen du gjorde tilsvarte at du var 10 år yngre, ville du sannsynligvis trene en ekstra gang dagen etter. De fleste pasienter ville ikke tatt i bruk et slikt produkt på egenhånd. Måtte fått det anbefalt av for eksempel fysioterapeut. For at fysioterapeuten skal kunne følge med på pasientens progresjon, må det være lett tilgjengelig for dem.

#### *-Generelt*

Dere bør sjekke ut hjelpemiddelsentralen på [www.nav.no](http://www.nav.no). Her kan dere lese litt om regelverk. Folketrygden dekker ikke sport- og fritidsutstyr. Dere må tenke på: hvis spillet skal brukes, hvordan får dere fysioterapeutene til å si ja? Hvordan får dere fysioterapeutene med på laget? Det kan sikker være en lur idé å snakke med både fysioterapeuter og ledelse.

Sånn til slutt så vil jeg si at jeg har tro på dette prosjektet!

#### *-Nye kontakter*

-Fysikalsk institusjon - fastlønnet stilling

-Høre med Sylvi Sand (72549553, [sylvi.sand@trondheim.kommune.no](mailto:sylvi.sand@trondheim.kommune.no)), hun vet hvem av de private klinikkene som driver med eldre. Har ansvar for fagutvikling

-Pensjonistenes fellesorganisasjon - Hornemannsgården. Spørre spørsmål angående forebygging. Høre med ledelsen at det er ok, når det passer. Inger Olsen (73841703) - daglig leder