

Master thesis



# Personal Health Records

**What business model opportunities are there for exploiting  
a Personal Health Record on the Dutch healthcare market?**

v.1.3

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HEALTHCARE

  
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*de ondernemende universiteit*

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## Abstract

This research formed a business model for Personal Health Records. This document starts off by explaining the modern healthcare situation, followed by a description of Personal Health Records. Then, the research presents scientific models and literature that are relevant for the business model for Personal Health Records which appears in the last chapter. Here these scientific models are combined and elaborated in the form of a holistic, concise business model specifically for Personal Health Records. Obviously in order to create a business model, literature regarding business modeling gets discussed as well.

Modern day healthcare is introducing more and more activities on the Internet, so called Medicine 2.0 or E-Health. There are various reasons why this shift is occurring but the biggest reason is the growing demand and the related growing costs that will (if nothing will happen soon) turn problematic in the near future. The costs of healthcare will go sky high and there will not even be enough health care professionals to put on the big demand. Medicine 2.0 and E-Health initiatives seem to be a solution for this problem as certain tasks can be done (partially) automatically or by the patient himself using web applications.

One of these E-Health popular initiatives is a Personal Health Record, a medical record that is managed by the patient himself thus discharging certain tasks from the healthcare professionals. Patients these days (and especially the next generations) thrive for more empowerment in their care processes as they simply are more mouthy and critical than earlier generations. They want to have the ability to choose between options to pick the one that fits their needs and they also want the ability to see their medical information and also have a control in who sees what.

The E-Health market is still new and especially PHR initiatives are still in their infancy and therefore little is known about the business side of things. How does one make money with a Personal Health Record in The Netherlands? In order to answer this question, this research examines the business logic needed for value creation based on concepts and models around Personal Health Records, researches into similar E-Health applications and even research into non-industry-specific (E-)Business models. Finally, these concepts and models of value creation are put together in a business model specific for Personal Health Records and with this business model, it is possible to assess the value creation logic behind a Personal Health Record.

Business models exist in many forms but are usually captured as (incomplete) ideas in the heads of strategic management. Recently, making a graphical representation of the business model gets more and more support as a good addition to business plans and business cases. A business model is a tool to give a holistic impression on the elements involved in value creation. Based on the research by Osterwalder (36), who formed a meta-model, the following elements are important to the logic of value creation: value proposition, target customers, distribution channels, relationships, value configuration, core capabilities, partner network, cost structure and the revenue model.

Not many business models for E-Health activities exist as the limited results of useful theories showed in the early stages of this research and frankly in practice in a lot of cases no clear business model even exists and businesses act opportunistic to the future problems that healthcare will be facing. So, the proposed business model for Personal Health Records described in this research can be seen as a first go at it. The process of how this business model for Personal Health Records got formed might be of interest for future E-Health business modeling research.

The business model has been presented and discussed with several experts regarding PHRs to get insightful feedback to alter or add some of the content, based on the interviewee his specific expertise. At the end of the research the business model was also presented at a business meeting at Pink Roccade Healthcare so that the management could share their thoughts. This business model can be used as a tool for the management to assess how to put a Personal Health Record into the Dutch market.

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## Preface



*“Every human being is the author of his own health or disease”*

Buddha

## Acknowledgements

I would like to thank everyone who had a contribution to this report and especially Joost Wagenaar and Hans ter Brake of Pink Roccade Healthcare for offering me the opportunity and support to conduct this research into Personal Health Records and Lisette van Gemert-Pijnen and Jann van Benthem of the University of Twente for their supervision, support and feedback.

Further, a thank you goes to some of my friends and family who perhaps did not contribute directly to this research but supported me throughout the months.

- Maarten van Limburg

# 1. Introduction

## 1.1 Background of the research

Medicine is one of the oldest sciences in the world. It is known that already in the prehistoric age, people learned through trial and error that certain herbs could cure them from certain illnesses. This knowledge got passed on over generations and eventually it got practiced by specialists, such as healers or shaman. Over the many millennia, medicine evolved as people began to understand more and more about the human body and the knowledge from other sciences such as chemistry. In the 20<sup>th</sup> century it gradually became a whole industry and is currently one of the biggest and -due to demographic trends- very interesting industries for businesses.

Ever since the arrival of Information Technology (IT) since the 1950s, every industry is changing rapidly, the healthcare segment is no exception on the rule here. This can vary from highly complex computers that aid robotic surgeries to the average desktop computers that keep track of schedules or orders of medication.

Certain IT trends that start in one sector and that are proven to be commercially interesting, quickly spread like wildfire to other sectors. In this case the whole web 2.0 phenomenon that started early 1999 with the arrival of the first web logs (aka. blogs) and quickly evolved into a whole spectrum of websites utilizing online content generation by users creating extra value for sales or more income through online advertising.

Currently, this web 2.0 technology is still at its infancy in the healthcare market, yet, early initiatives are taken - such as Health 2.0 and Medicine 2.0- to specify this new technology and its benefits for the current healthcare sector. Globally speaking already quite a few businesses are looking for opportunities to exploit this new technology, as the healthcare system has to change.

This is where this research steps in. When businesses want to step in on new opportunities, this requires a business model to combine strategy with certain business logic. However, as this Medicine 2.0 phenomenon is fairly new, no scientific business models exist yet that are usable for this research to form a business model for Personal Health Records. Ergo, this research will take existing business models from related areas and combine them into a new business model specifically for a Personal Health Record service.

## 1.2 Problem definition

As said in the previous chapter, Medicine 2.0 is a new opportunity for businesses to find new ways of making money, however this realm is quite new, therefore there has not been much research yet into business logic and business models how to make money with Medicine 2.0 applications. Medicine 2.0 is a quite broad term and thus has potential for a lot of applications, basically in short everything that involves health(care) using web 2.0 technology would fall under the cognomen 'Medicine 2.0'. It stands out from traditional healthcare in the sense that the web 2.0 technology allows interaction between patients and health care professionals using the Internet.

This research specifically looks at Personal Health Records (PHR), one of the applications Medicine 2.0 can offer. Also for Personal Health Records there has not been any scientific research thus far into business models for such a service. This research will compose a business model for a Personal Health Records service from the perspective of the vendor, in this case Pink Roccade Healthcare, describing strategic decisions the management of Pink Roccade Healthcare has to make regarding the value creation logic behind offering Personal Health Records on the Dutch healthcare market.

In an article published by the European Commission (17), they pinpoint the lack of organizational and financial knowledge regarding Personal Health Records and thereby stressing the significance of research into this area:



*“In a recent conference organized by the EC, the challenges for the deployment of PHS (Personal Health Systems) were discussed. Technology is not the biggest barrier to deployment. Of course, certain technological aspects like standardization, interoperability, user friendliness, reliability and dependability need to be fully addressed so that PHS can receive the indispensable support of the users. The major factors that need to be tackled in order to harness the benefits of PHS include proper organizational structures; reimbursement and economical viability; legal framework regarding liability, privacy and cross-border services; and regulatory aspects such as certification of PHS.” (Gatzoulis, L., Iakovidis, I. 2007) (17)*

### 1.3 Research Objective

The objective of this research is to apply concepts and value creation logic from other academic studies along with insights from experts within the particular Dutch healthcare market to form a business model that sets out a holistic view for the value creation logic regarding Personal Health Records. The business model framework introduced by Osterwalder (36) is also the framework for the business model that is formed in this study and gets elaborated with business logic and critical design issues that are specific for Personal Health Records. The resulting business model was also presented to Pink Roccade Healthcare, the company that requested and funded this research. Their views regarding the business model can also be seen as a test case to see if the business model is valid and thorough.

### 1.4 Research questions

Based on the problem definition, the research question is:

*What business model opportunities are there for exploiting a Personal Health Record on the Dutch healthcare market?*

In order to answer this question, the research is divided in sub-questions.

1. *What is the market?*

In order to create a business model, one has to be aware of the scope and the typicality of the Dutch healthcare market and of Personal Health Records specifically. The intent of this question is to introduce the Dutch E-Health market and obviously the market for Personal Health Records. This chapter shall introduce the situation of the current healthcare system, describe E-Health or Medicine2.0 and finally describe Personal Health Records. This chapter works as a foundation to gather literature about related business models.

2. *Who is the market?*

This question continues the search into the market but focuses more in depth on who the customers (or user groups) are and what their needs are regarding Personal Health Records. Most of these findings are based on scientific literature accompanied by insights from interviews by experts and presentations.

3. *What relevant business models are available in literature and how can they be useful for Personal Health Record services?*

As already stated, at the time this research started no business model specifically for Personal Health Records can be found yet in scientific literature, hence this chapter will target on finding business models in areas that are related to Medicine 2.0 by dissecting Medicine 2.0 into loose terms and relating these terms to existing models. This chapter will look at value creation logic and business modeling in general plus especially business models for E-Business.

#### 4. *The Personal Health Records Business Model*

The last step of the research is combining all findings into a concise, informing business model, specifically for a Personal Health Record in the Dutch (E-)health market. This business model gives management a holistic view on the opportunities and options they have when it comes to putting a Personal Health Record in the Dutch healthcare market.

### 1.5 Research Design

The following diagram shows in big lines how the research was conducted based on research design guidelines by Babbie (6) and Yin (50, 51), starting with defining the situation and key concepts in the theoretical framework phase, this framework was the base for the research. In the second phase specific information was gathered via interviews and by looking for more specific business logic theories that are relevant for Personal Health Records. The final step was assembling all insights into the actual business model, based on the business model blue print by Osterwalder (36), and describing the opportunities.

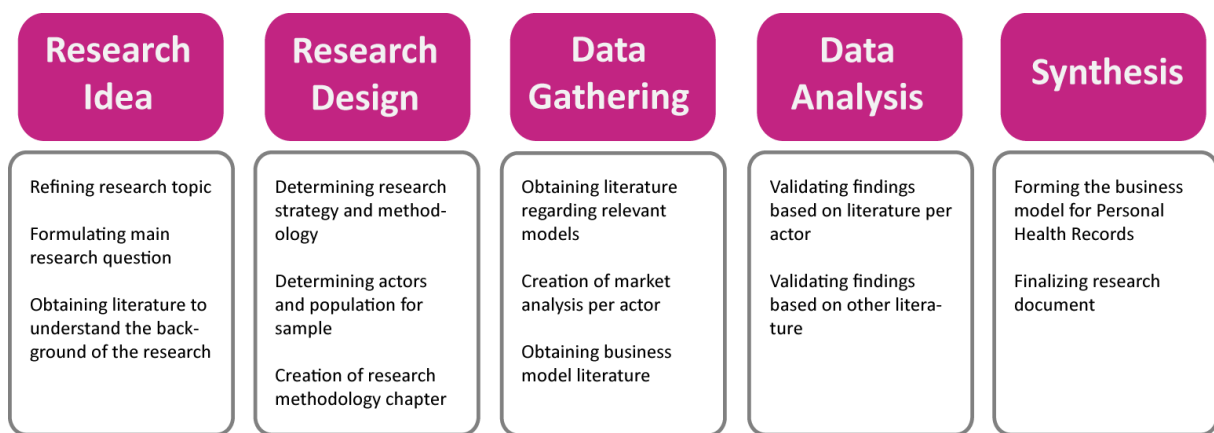


Figure 1.1: Research Process

## 2. Research Methodology

### 2.1 Strategy

The research strategy can be summarized into the following steps:

- Gather relevant models regarding Medicine 2.0 and Personal Health Records and business modeling;
- Pick one business model design method as a framework for the research;
- Assess which critical design issues or which value creation logic will fit the business model for Personal Health Records based on (scientific) literature;
- Elaborate these theories how they relate to Personal Health Records;
- Conduct inquiries with experts to confirm\sharpen the theoretical findings and combinations;
- Combine findings into a business model for Personal Health Records, with an elaboration of the opportunities.

### 2.2 Constructs

Clarifying the key terms (known as constructs or concepts) in the research is important. As Shadish, Cook and Campbell state in their book on experimental and quasi-experimental designs (43) is that most experiments are highly localized and particularistic; however the scientific interest is into the theoretical constructs and a larger policy. Sound constructs are important for generalizing.

Babbie (6) gives another reason why constructs are important and that is that you need clear and precise definitions of what you want to research. A nominal definition can be ambiguous therefore it is important that one specifies the operational definition as well. Especially when doing surveys or interviews, it is important that both the interviewer and the interviewee are on the same level when it comes to certain jargon. Doing this phase in the research properly shall increase the construct validity.

A few key concepts appear in this research, in the table underneath these concepts are defined:

Personal Health Record(s)	<p><b>Definition:</b> An electronic application through which individuals can access, manage, and share their health information in a secure and confidential environment (Markle, 26)</p> <p>Synonyms: PHR, PHR2.0</p>
Business Model	<p><b>Definition:</b> A business model is a conceptual tool that contains a set of elements and their relationships and allows expressing the business logic of a specific firm. It is a description of the value a company offers to one or several segments of customers and of the architecture of the firm and its network of partners for creating, marketing, and delivering this value and relationship capital, to generate profitable and sustainable revenue streams. (Osterwalder, 36)</p> <p>Synonyms: -</p>

Medicine 2.0	<p><b>Definition:</b> Medicine 2.0 applications, services and tools are Web-based services for health care consumers, caregivers, patients, health professionals, and biomedical researchers, that use Web 2.0 technologies as well as semantic web and virtual reality tools, to enable and facilitate specifically social networking, participation, apomediation, collaboration, and openness within and between these user groups. (Eysenbach, 14)</p> <p><b>Synonyms:</b><sup>1</sup> E-Health, eHealth, Health 2.0, telemedicine, telehealth</p>
Web 2.0	<p><b>Definition:</b> Web 2.0 is the business revolution in the computer industry caused by the move to the Internet as platform, and an attempt to understand the rules for success on that new platform (O'Reilly, 33)</p> <p><b>Synonyms:</b> -</p>
E-Commerce	<p><b>Definition:</b> The buying and selling of products or services over electronic systems such as the Internet and other computer networks. (Timmers, 48)</p> <p><b>Synonyms:</b> E-Business</p>
Service	<p><b>Definition:</b> A process consisting of a series of more or less intangible activities that normally, but not necessarily, take place in interactions between the customer and service employees and/or physical resources or goods and/or systems of the service provider, which are provided as solutions to customer problems. (Bouwman, 7)</p> <p><b>Synonyms:</b> -</p>

Table 2.1: Constructs

## 2.3 Operationalization

Operationalization comes after the conceptualization and it involves the development of specific research procedures (operations) that will result in empirical observations (Babbie; 6).

The research is an exploratory case study. A case study is an ideal methodology when a holistic, in-depth investigation is needed (Feagin, Orum, & Sjoberg; 16). Yin (50) has identified some specific types of case studies; the exploratory case study is applicable for this research, as this research is trying to look for a business model that would fit a Personal Health Record service in The Netherlands, via related models and transposing these models into the business model of Osterwalder (36). The business model was used to communicate business opportunities regarding a Personal Health Record product. The context of Pink Roccade Healthcare was taking into consideration therefore this case study is single-case and not multiple-case, however many of the findings should be applicable to any Dutch organization that is interested in putting a PHR in the Dutch healthcare market.

When data analysis follows predefined theory or certain theoretical patterns, the research approach is deductive; when the theory gets developed during or with the analysis of collected data, the research approach can be seen as inductive. (Saunders, Lewis, Thornhill; 40). Both approaches appear in this research, as explained later.

In the figure on the next page the relations between the concepts are demonstrated. The research started with key literature regarding Medicine 2.0 and business modeling and then went on to specific literature about Personal Health Records and more specific models regarding business modeling, being service business modeling.

After that, the business modeling took a step towards the Internet, introducing several E-Business models. This step was inspired by Parente (37), who already discovered "regular" E-Business models were also applied for offering E-Health services/products.

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<sup>1</sup> More like related terms, due to no dominant terminology used altogether to obtain diffused information

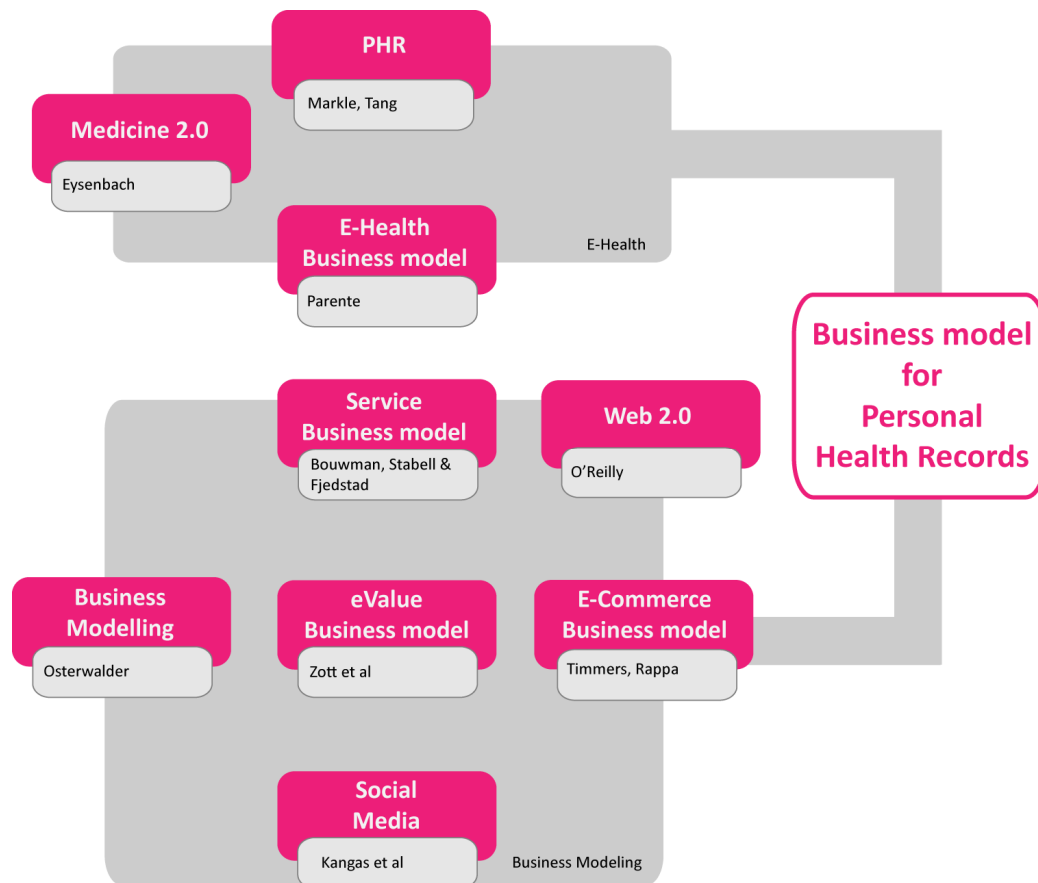


Figure 2.1: Searching strategy for literature

The research contains both a theoretical as a practical approach. The theoretical approach is needed to develop the model from existing literature that is already available. This is a so called deductive approach, where business logic gets adopted from other research in a new way. The main source of input is scientific literature, from which useful theories were selected and combined in this research.

Next to the scientific literature, some supplementary insights were found via discussions, blog entries and similar sources of information on the Internet, as PHRs and EMRs are hot topics of debate currently. These insights are inductive. This method is known as the constant comparative method (Babbie; 6), where observations are used to assess the in this case, evolving business model.

The other source of information, the interviews with experts are also in line with the constant comparative method. To validate the theoretical findings and to add more insights from several experts (for as far the confidentiality permitted) at the end of each search for models, experts gave their opinion and their views, using in-depth interviews. The questions that were asked were semi-structured, meaning beforehand several topics and general questions were thought out but during the interview follow-up questions just emerged naturally and usually took the form of a discussion where the interviewer and interviewee swapped their views on certain topics.

To make sure the research also reflected the market on a more practical and less theoretical scale, also experts within Pink Roccade Healthcare gave their opinion about the business model.

When formulating the research questions the following hints from Babbie (6) were taken into consideration:

- Make items clear; therefore all terms got their definition during the interview;
- Avoid double-barreled questions;
- Respondents must be competent to answer; Speak with experts in the field, asking questions related to their profession;
- Respondents must be willing to answer; Be open about your findings so that both the interviewer and interviewee could learn from each other;
- Questions should be relevant;
- Avoid biased items and terms; Try to ask questions from an objective researcher point of view.

The final part of the research is where all the above findings are put together into the Personal Health Record business model. This business model was presented internally in front of the management of Pink Roccade Healthcare and thus this phase can be seen as a final test case for the Personal Health Record business model, as here all the theoretical puzzle pieces needed to fall in their place and make sense in the empirical world.

## 2.4 Research instruments

The research used two research instruments:

- Literature study
- Interviews

Literature was at first gathered to get an impression of the Dutch healthcare market, Medicine 2.0, Personal Health Records and the process of business modeling. The models found in this literature can be seen as the theoretical framework, as it provided the basis to start sampling. This research carried on with collecting even more literature to deepen the business logic and value creation logic that was needed to form a business model specifically for Personal Health Records. With the nine building blocks of the Osterwalder business model in mind, literature was gathered from various databases and summarized and related to Personal Health Records.

For the interviews, a list of topics was made beforehand, relative to the expert that was being interviewed. The interviews were semi-structured interviews, so during the interview additional questions could be asked, which allowed going deeper into details when necessary or when answers were not complete or satisfactory for the interviewer, the necessary details were found with follow-up questions. In a few cases the interviews became more a discussion than really following the list of topics.

Based on the prepared topics, the interviewer took notes and kept a red line in the discussion to make sure every item was mentioned. Often this process was not totally linear but in the end all the questions were dealt with and satisfactory input was given.

## 2.5 Sampling methods

In both the theoretical part as the interview part of this research snowball sampling was used. Snowball sampling is a non-probability sampling technique where one sample leads to the next (Babbie; 6). This snowball sampling technique was excellent to find key authors regarding certain topics, again, especially in the E-Business literature this technique was proven to be very helpful as a lot of similar literature exists.

The research started out with a few basis articles that were hinted by the mentors.

For obtaining the articles the following websites and their search engine were used:

- Journal of Medical Internet Research (JMIR);
- Journal of the American Medical Informatics Association (JAMIA);
- Medline, searched via PubMed;
- Scholar.google.com (mostly for the business modeling and E-Business models).

The definition of Medicine 2.0 contains several keywords that worked as input for snowball sampling for business models and their value creation logic. These keywords are highlighted in the definition:

*“Medicine 2.0 applications, services and tools are Web-based **services** for **health care** consumers, caregivers, patients, health professionals, and biomedical researchers, that use **Web 2.0 technologies** as well as semantic web and virtual reality tools, to enable and facilitate specifically social networking, participation, apomediation, collaboration, and openness within and between these user groups.” (15)*

So this gives three main areas to search for business models:

- the service area (service, service innovation, ICT\IT services)
- the health care area (E-Health, Medicine 2.0, Health 2.0, Telemedicine),
- the web 2.0 area (E-Business, E-Commerce)

Keywords from the aforementioned concepts were used in various scientific databases and the abstracts of the results on the first 5 pages of hits were read and when the topic and abstract seemed relevant enough, the article was selected for use and skimmed through wholly to see if it would add relevant information. Eventually if that was the case, the article was read wholly.

Especially in the E-Business and E-Commerce literature a lot of studies were very complementary or almost similar but most articles contained references to key authors that were used in this research.

Also several experts in the academic world gave advices for potential useful literature, especially regarding E-Commerce and research into the demands for eHealth applications, their expertise was tremendously helpful as considering the timeframe of this research these findings could not have been produced during this research and/or would harm the intended holistic view.

For the interviews, convenience sampling was used. Joost Wagenaar (mentor at Pink Roccade Healthcare) and Lisette van Gemert-Pijnen (first mentor at university of Twente) composed a set of names of people that could give relevant insights. In the research the importance of change agents and opinion leaders is addressed in the model about adapting to innovations, hence some of the interviewees are such opinion leaders. Also here snowball sampling was applied, asking the interviewees if they also knew additional information sources.

The areas in which the interviewees operate were the following:

- E-Health Research;
- E-Commerce Research;
- E-Health Organizations;
- Insurance companies;
- Segment managers inside Pink Roccade Healthcare.

Yin (51) suggests using multiple sources of evidence as the way to ensure construct validity; therefore findings from literature were cross-referenced with ideas of the interviewee, especially considering many of the literature was based on the American or Canadian healthcare market/system. In many cases these findings matched or were argued to fit the Dutch healthcare market/system.

## 2.6 Data analysis methods

The first phase of the research began with searching for mostly explanatory research on key terms, such as Personal Health Records and Medicine 2.0. Based on these findings and combined knowledge from several sources and the introduction part of the theoretical framework was written.

The next step was to sample and collect literature from other business models, literature and models on value creation and on business modeling as a process by itself. Obviously the business models had to be relevant, hence as already explained, by dissected the term 'Medicine 2.0' and searching for business models based on key terms like service, web 2.0 and healthcare several business models were found and used. From these models business logic and critical design issues were extracted and added those to the Personal Health Record business model.

Next to the theoretical process also interviews were conducted to gather empirical evidence for my theoretical findings and to fill up gaps that the literature could not manage to cover by basically discussing the findings.

Based on the above assessment, the final business model for Personal Health Records was written.

## 2.7 Scope and limitations

This chapter explains the scope of the research as well as the limitations that have been taken into account.

First of all, the whole research is limited to a time span of six months, which is the official duration set by the University of Twente, as well as the duration of my contract with Pink Roccade Healthcare. Therefore the research started the 1<sup>st</sup> of October 2008 and had to be finished at the 1<sup>st</sup> of May 2009.

The research is aimed at the current and future situation in The Netherlands. This has a few implications, for one that the number of experts in the field is limited. As the number of people to talk to is pretty limited, this might harm the statistical validity. Obviously with small numbers 'the more, the merrier' applies because then the reliability increases. One could argue the level of generalization.

This research relied heavily on third party research as a holistic view, such as a business model, contains so many aspects that investigating each aspect individually in great detail by myself would not be realistic. The novelty of this research lies in the fact that it combines theories from two academic worlds. Metaphorically speaking it 'puzzles' a business model together from all the relevant and available scientific material.

The used third party research quite often was international. The validity for The Netherlands specifically is then at risk, as for instance the American healthcare system is very different to the Dutch healthcare system. Hence these specific requirements and statistics that were based on the American population were avoided and replaced (if possible) with Dutch equivalents. For the parts that were used, the transferability of the information was not questioned as it is assumable that the information is of a generalizable nature.

Another problem with using a lot of research and entwining their results into your own model, is the fact that the concept validity and the internal validity (how you relate the concepts) is under pressure. Concepts and their operationalization are always slightly different per research paper, especially because of the young nature of eHealth, concepts are still evolving and fine-tuning. However, knowledge is transposed from other fields of expertise anyway, thus the relationships and its relevance need to be clear.

The research was conducted for Pink Roccade Healthcare, so even though the research was as objective as possible, some choices were predetermined. Such as looking at internal products and some collaboration prospects were already ruled out beforehand due to business politics. Also the potential connections of a Personal Health Record with actors that are not in line with the current business of Pink Roccade Healthcare got neglected purposely, to keep focus.



# 3. What is the market?

## 3.1 Brief introduction to the future of the Dutch healthcare market

Schnabel, director of the Social Cultural Planning Bureau in the Netherlands, released in May 2008 a document (41) about the future of the Netherlands in a social-economic perspective. He describes a few trends that the Dutch society will be confronted with starting in the next decade. The following paragraphs describe effects on the Dutch healthcare market based on these trends. This background information has implications on the value proposition in the business model for Personal Health Records as it already hints certain market needs that a PHR service should satisfy. Next to that it also introduces the actors and environment the Personal Health Record service is situated in.

### Growing demand for healthcare

The Netherlands, just like many other countries, experienced a baby boom right after World War II. These so called baby boomers are people born in the 1946-1964 era and are currently reaching the age where they retire and require pensions and similar financial arrangements for their latter days and no longer participate in the labor market, the so called obsolescence (41). Older people have more health issues than younger people<sup>1</sup> and people tend to get older due to better care so the demand for healthcare in the future shall be significantly higher than the current demand. Next to that, these days people tend to use health care facilities much easier and much more frequent than in the past as the following anecdote illustrates:

*"The impact of the boomer generation's aging on the health care system has been referred to as an age quake because medically, it is the equivalent of a massive earthquake. The demands on the system are enormous and growing," says University of Michigan Health System family physician Lee Green, M.D., M.P.H. (...) "When my grandparents reached old age, health care was something that people avoided, but boomers seek it out," Green says. "They expect to be healthy, stay healthy and be fixed when they aren't healthy." (Senior Journal, 2005) (42)*

Another example of the growing usage of healthcare is the growing number of medicine users which grew from 28% in 1995 to 37% in 2005<sup>11</sup> and this growth of 10% is expected to continue in the future. (27)

The growing number of people requiring healthcare and the growing usage of healthcare both cause a bigger demand and puts pressure onto the market. Already there are the notorious waiting lists on treatment in the Netherlands and considering the growing demand, those lists can only get longer if nothing gets done about it.

A positive prospectus is that current youngsters are more aware of their health (27) and pursue a healthier lifestyle than the baby boomers, by sporting or fitness and eating healthier diets. Obviously this means they do not need healthcare services as often. However, this will not have a significant (enough) lowering effect on the future demand.

### Healthcare costs

People generally get older due to better health care and developments in new treatments and new medication, thus they also keep using health care facilities over a longer time span than before. (41) E.g. treatment for cancer was 20 years ago still rather limited yet nowadays most forms of cancer can be put to a halt with an early discovery of the illness and good treatment.

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<sup>1</sup> LINH statistics show that in 2005 people under the age of 45 do about 45 million doctor visits a year, while people over 45 do about 75 million doctor visits a year, that is 66% more.

<sup>11</sup> Based on CBS figures.

People getting older and curable is a good thing obviously, no doubt about that, but if you look at the costs these expensive treatments generate one has to admit the financial consequences too. Because of better treatments and more treatments, healthcare got more expensive per person too.

In the labor market also various trends occur. First of all, due to the aging population and diluting growth of the population there shall be more elderly people than youngsters. This demographic shift (41) will cause financial problems regarding public services including - and perhaps because of the importance of well-being, especially - in healthcare. The Dutch government is already trying to anticipate this problem by altering the participation in the labor market. Examples of these anticipations are: increasing the retirement age, arranging that people who are currently considered unfit for work *do* get a job and opening the borders for workers from other countries of the EU.

Also a beneficial trend is happening though. Women are increasingly participating in the labor market (41). This weakens the financial effects of the obsolescence a bit as they will carry a part of the financial burden as well.

A special case of expanding costs in healthcare comes from the so called Baumol's cost disease (27), a phenomenon Baumol discovered in the entertainment business but that also applies on health care professionals:

*"(..) the problem of financing the performing arts in the face of ineluctably rising unit costs. These, they argued, are the result of 'productivity lag'. (...) As Baumol and Bowen point out, the conditions of production themselves preclude any substantial change in productivity because 'the work of the performer is an end in itself, not a means for the production of some good'."(Heilbrun; 19)*

In other words what Baumol discovered is that the tasks of a health professional did not change much over the years. That means his productivity remains the same (e.g. same number of patients a day as 20 years ago). His wage however did increase due to raising wages in industries where the labor productivity *had* increased. In the table underneath this effect is demonstrated:

1980	Health care professional	Car engineer
<b>Productivity</b>	1,000 patients	1,000 cars
<b>Income</b>	\$100,000	\$100,000
<b>2000</b>		
<b>Productivity</b>	1,000 patients	1,200 cars
<b>Income</b>	\$120,000	\$120,000

Table 3.1: Example of Baumol's Cost Disease

The numbers in the table are fictive but it shows that in 20 years the healthcare professional got relatively speaking a factor of 1.2 more expensive than people working on other industries, whose income grew correspondingly with their productivity.

Politicians already broached several structural changes for this problem such as more transparency and less bureaucracy in hospitals to increase the productivity of the professionals. However since these are quite big steps, it already take years to grow awareness and acceptance let alone making it actually happen. From the medical world there are all sorts of cries coming towards politics to actually take responsibility<sup>1</sup> or things get ugly.

Commercial parties see opportunities to offer services that anticipate to these problems and on the long-run offer a potential solution and revenue.

<sup>1</sup> [http://www.rug.nl/fwn/nieuws/fwnActueel/archief/archief2008/persberichten/069\\_08](http://www.rug.nl/fwn/nieuws/fwnActueel/archief/archief2008/persberichten/069_08) (Dutch)

### 3.2 Visions on healthcare

The future of healthcare is a hot topic so many institutes put research into what the future is going to bring. The social-economical changes discussed in the previous chapter will occur at some point so a lot of speculation about how to adapt to them goes on.

The Dutch Ministry of Healthcare published a report (28) that depicts four different scenarios of how the Dutch healthcare system will look like in 2020 depending on the variability of economic growth and whether healthcare is publically or privately orientated. This vision puts the need for Personal Health Records in perspective, especially in the Rich Choice Perspective and the Selective Growth scenarios a Personal Health Record can be a vital part in the renewed healthcare as both are very individualized onto the patient himself.

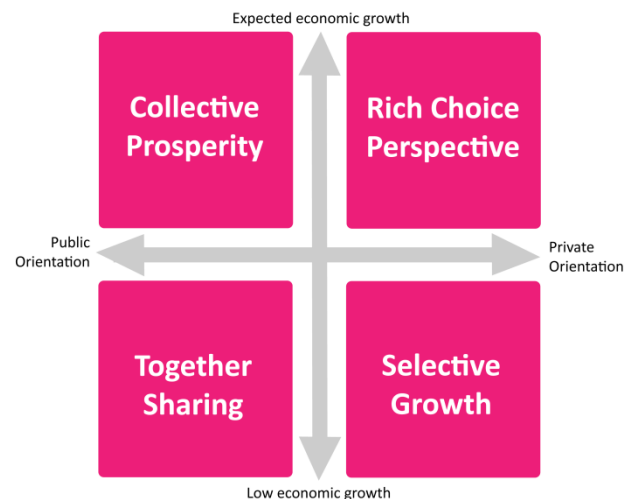


Figure 3.1: 4 scenarios of healthcare

The table underneath describes the four scenarios briefly:

Scenario	Description
Collective Prosperity	In this scenario the government has a lot of influence in healthcare; the whole healthcare structure has been positively altered for everyone. It is economically going good with The Netherlands, citizens have to pay taxes according to their income and the government spends a great deal of its annual budget on healthcare. Also investments in other areas such as education and research help the effectivity of healthcare. The effects of the obsolescence are minor due to a high birthrate and slight migration of foreign workers.
Rich Choice Perspective	Here the individual is very central, the healthcare structure got moderated and healthcare is mostly arranged via private arrangements. Income differences become very apparent due to the moderation. The material prosperity is the highest in this scenario.
Together Sharing	Collectivity is the most important theme in this scenario. The economical growth is low and a lot of collective arrangements emerge hence taxes are high and incomes are leveled, causing unemployment and low productivity (people get demotivated because of the high taxes). Whatever is available shall be shared among the people.
Selective Growth	The last scenario describes selective growth. The economy is not going well and the health care structure is reformed to a very minimal basic set. All citizens have to decide themselves what private arrangements they want and can afford, so called 'do-it-yourself'-healthcare. This scenario feels the biggest effect of obsolescence as labor participation is very low and due to the negative nature of the society, the birthrate is low. it's a typical 'survival of the fittest'-scenario. The rich can afford all the best care, the poor have to work magic to finance certain health care facilities or otherwise they simply just cannot afford it. The "Easy-Jet"-philosophy of custom combined with cheap kicks in.

Table 3.2: 4 scenarios of healthcare

### 3.3 Internet and healthcare

One of the most popular solutions to the rising problems in the health care market is utilizing the benefits of Internet in the healthcare sector. In other markets, such as commerce, the Internet has proven to be a new way of doing business, so called E-Business or E-Commerce. E-Business practices compared to traditional business become relatively lean and mean and this could tackle the rising problems in healthcare.

E-Business or E-Commerce in regard to healthcare is often referred to as E-health. DeLuca et al (12) described the role of Internet in Healthcare for the US in their article; obviously the effects they mention also apply on any country thus also the Netherlands:

*“Even as its form and structure continue to emerge, e-health is being used to change business and medical practices, affecting every facet of the American health experience. Business, medical, social, and technological factors are converging to make wide-scale, continuum-based care functionally achievable perhaps for the first time. The Internet clearly drives the development and adoption of e-health applications; standing alone, it has the reach, the infrastructure, and the acceptance to achieve widespread change. As the public grows increasingly Internet-enabled, healthcare organizations have an opportunity to cost-effectively reach a large part of the U.S. population.” (Deluca, Enmark; 12)*

The leading technology on the Internet currently is the so called Web 2.0 applications, allowing interactive and dynamic information-sharing processes. This also allows patients to participate more in their health processes, known as patient empowerment or in a more E-Commerce term: consumerism, which is another vanguard of healthcare of the future.

The following chapters shall introduce the concept Web 2.0 followed by its healthcare derivative Medicine 2.0. In the chapter ‘Why Medicine2.0?’ the role and benefits of Internet in healthcare gets explored more in-depth.

### 3.4 Web 2.0

Before jumping into the world of Medicine 2.0 it would be valuable to understand the world of Web 2.0 first, as both terms are quite related. The term Web 2.0 originates from a conference in 2004 held by O’Reilly (34) describing a new trend on the World Wide Web. Whereas Web 1.0 was merely a static information delivery service, Web 2.0 introduced interaction and thereby creating a whole new social and quality management edge to the way information is delivered to and perceived by Internet users.

This Web 2.0 trend started with the start-up of Google in 1996, a search engine that orders the results based on page visits (thus interaction) and is the first well-known web 2.0 application, making Google the pinnacle of the Web 2.0 phenomenon. A few years later several blog sites appeared where people could keep an online diary and comment on each other, as well as other initiatives that currently are widely known and popular web pages such as Wikipedia and Myspace. (23) All these web pages became successful Web 2.0 web pages.

O’Reilly defines Web 2.0 as:

*“Web 2.0 is the business revolution in the computer industry caused by the move to the Internet as platform, and an attempt to understand the rules for success on that new platform.” (O’Reilly, 33)*

This ‘platform’ means a set of principles and practices that appear in several applications. Without going into much detail about them (they are too technical for the scope of this research) but just to be complete here is the list of these principles and practices that O’Reilly discusses in his article (34):

- Collective intelligence - user activity can be used for selection and ordering of information;
- Blogs and RSS - chronologic, diary-like chunks of information (aka feeds);
- Data is the new Intel Inside - the value of the service lies in the database;
- Service, not software - a notable shift from standalone software to online services;
- Multiplatform - not only PCs, but multiple devices can access the services;
- Rich user experience – web pages are not just plain-text, but software application alike.

### 3.5 Medicine 2.0

Medicine 2.0 is a term invented by Eysenbach (15) to cover all practices of medicine using web 2.0 technology. Medicine 2.0 is not the only term trying to capture this phenomenon, there are actually quite a few terms buzzing around, notable ones being: Health 2.0, eHealth or E-Health and even Telemedicine and Telehealth are applicable. These terms all try to encapsulate the same phenomenon yet in this research the term Medicine 2.0 gets the favor as it is the most thoroughly defined and specified one, plus it gets the most academic support<sup>1</sup> as it addresses the social networking aspects stronger. Hughes et al (2008) wrote a paragraph on the differences between Health 2.0 and Medicine 2.0 in his paper on the tensions both phenomena face:

*“As such, neither the stakeholders nor the principal tool used (the Internet) distinguishes Medicine 2.0 from eHealth. However, the principles of open source, generation of content by users, the power of networks, personalized health care, and the focus on collaboration across all stakeholders are not always highlighted by eHealth and suggest that these fields have different emphasis.” (21)*

Even though Eysenbach claims it is too early to formulate an absolute definition for Medicine 2.0 he did mention a presumably preliminary one in his Medicine 2.0 article (14):

*“Medicine 2.0 applications, services and tools are Web-based services for health care consumers, caregivers, patients, health professionals, and biomedical researchers, that use Web 2.0 technologies as well as semantic web and virtual reality tools, to enable and facilitate specifically social networking, participation, apomediation, collaboration, and openness within and between these user groups.” (10)*

There are three main user groups in Medicine 2.0 being the patients, health professionals and biomedical researchers (14). These groups can be put in a triangle and somewhere inside the area can Medicine 2.0 applications be placed, depending on their specific focus on aiding which user groups. The appearance of Medicine 2.0 will change the original roles between these user groups; the traditional hospital-based medicine shall transform in healthcare in the homes of the patients.

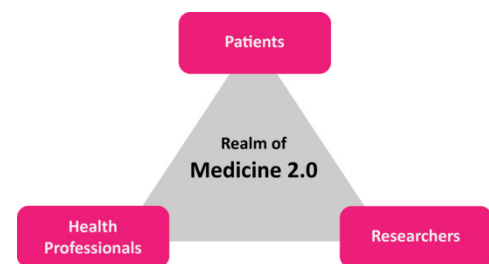


Figure 3.2: The Medicine 2.0 triangle

Already mentioned in its definition Medicine 2.0 consists of five major ideas or themes that (should) reappear in web 2.0 applications or tools for healthcare practices (14): social networking, participation, apomediation, collaboration and openness. The following paragraphs explain these themes.

#### Social networking

Social networking is a social structure of individuals or organizations that are tied up by one or more interdependencies. General examples of such interdependencies can be age, gender, relationships or location but also Medicine 2.0 specific ones can be surmised such as people having the same illness or people who see the same doctor. Due to these interdependences information can be selected, filtered and even processed by peers, making the information more relevant and of a higher quality. This phenomenon is known as collaborative filtering and can be seen as quality control placed at the end-user.

**Note:** the word ‘patient’ implies a health condition, which is not necessarily the case, for completeness a ‘patient’ also entails a ‘care consumer’ – someone who is actively busy with maintaining his health and wellbeing and spending time and/or money on that.

<sup>1</sup> Eysenbach has ties with the university of Twente

Next to that, the social aspect of it could keep people interested enough to keep their online health data up to date, a so called 'social incentive'. In Eysenbach his article "Law of Attrition" (13) he describes how patients tend to lose their interest in online health applications after a while. However, current youngsters<sup>1</sup> spend ages behind their computer keeping their profiles up to date on social networking websites such as Facebook and Hyves (the Dutch equivalent of Google's Orkut) so if the 'social incentive' is high enough, they might use Medicine 2.0 applications equally vividly and without losing interest. Imagine for example how pleasant it would be if you could chat with people who share the same illness to discuss dealing with the side effects of the medication.

## Participation

This part is rather essential for this research as it really applies on Personal Health Records (see 2.5 for details about this term). Already for decades researchers flirted with the idea of opening up healthcare processes and bringing it closer to the patients, empowering them in the process. In the beginning people were rather skeptical towards this idea as they want professional and individual-specific advice but the culture is changing. Again, Wikipedia is a good example where multiple end-users participate to gradually improve the quality and richness of the online encyclopedia. The basis herein lies in "trust your users" which is something very typical for Web 2.0 as O'Reilly explained with the term collective intelligence (34) and evolved into what is called crowd sourcing and collaborative intelligence, where businesses actively involve their end-users in activities normally performed by employers. This form of media is known as Social Media.

Social Media is popular in web 2.0 applications, take for instance the "people who bought this book also bought these"-feature on Amazon or even the order of search results on Google is based on the frequency of people click on a certain link. A very good example of putting quality management in the hands of the end-user is Wikipedia; even though not as complete or always correct (hence a subject for skepticism), a study showed that on popular science subjects the content was almost as accurate as the infamous Encyclopedia Britannica (47). So similar social media features could also work magic for health information on the World Wide Web.

**Example:** Next to a crème to heal my swollen foot, the doctor also puts a "package" of information about it in my PHR. At home I can browse through several websites and reviews (selected by a professional!) on this particular health problem and the crème the doctor gave me.

As for healthcare, what if next to a consent the patient also gets access to related information available on the Internet based on information that other doctors of even experienced patients have gathered. In case of Personal Health Records, the involvement and empowerment lies also in keeping the data personal. The best way to explain this is by an example.

Another side of participation is the participation in research. When patients go see a doctor their main interest is getting a proper, personal diagnose and treatment rather than, blatantly put, being a guinea pig for science. However a PHR can open doors for researchers. Obviously due of privacy legislations users of the PHR still have to accept whether or not to participate in this but the barrier shall be considerably lower.

Referring to the 'swollen foot'-example again, reviews and detailed day-by-day experiences of the crème would be excellent data for medical research and a potential solution to alter the medication or treatment.

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<sup>1</sup> Known as "Generation Y" or "Millennials" born in 1980-2000 range.

Arina presented a figure that shows the Power Law of Participation (4), based on a publication by Ross Mayfield. In this figure (depicted on the right) you see how a growing level of engagement adapts the collective intelligence to collaborative intelligence. Main difference between the two is that collaborative wisdom has the 'truth by consensus'-issue whereas with collective wisdom the people with knowhow share it to those interested. In collaborative wisdom, something is considered true if the majority supports what is stated, aka wikiality<sup>1</sup>.

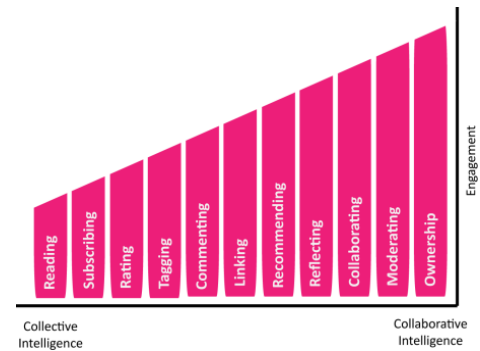


Figure 3.3: Power Law of Participation

As already pointed out, handling privacy issues is an obstacle not to be taken lightly and makes participation tricky due to the rigid security requirements and a lot of legal guidelines.

## Apomediation

Apomediation is a term Eysenbach invented to avoid using the term Web 2.0 application in scientific debates (14), as not every medical scientist is too keen on the Web 2.0 term.

There are three ways of mediation:

- Intermediation;
- Disintermediation;
- Apomediation.

Intermediation is the most common form of getting healthcare, you feel something and you go visit and consult your doctor for further information. The health professional in this case acts like a middle-man or gatekeeper.

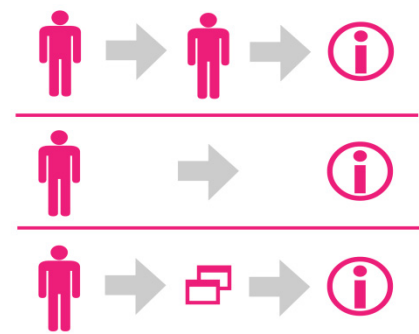


Figure 3.4: 3 forms of mediation

Disintermediation is when patients go look for information themselves. This might sound unwise and potentially dangerous but happens a lot<sup>11</sup>. The Internet is full with (dis)information so if a patient does not know what he is exactly looking for he might get lost looking for it or even worse, take the wrong advices. Still the majority of patients first search the web when they encounter health problems to get information before they go and see their doctor eventually.

Then there is apomediation, which is like a bit of both intermediation and disintermediation. Patients go look for the information themselves without having a health professional in between but instead there is a tool that guides them to the relevant information to avoid the problems disintermediation may cause. A Personal Health Record can also be seen as an apomediator, as the tool allows patients to access their health information and it facilitates them to grasp and manage this information by themselves and incorporate only the vital and relevant medical information into their Personal Health Record.

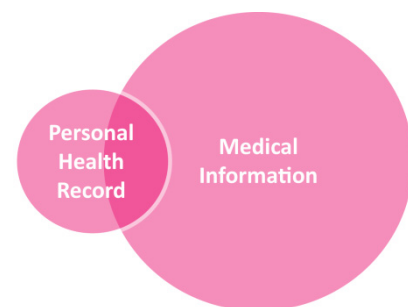


Figure 3.5: PHR as apomediator

Not only the patient can benefit from apomediation, also health professionals can benefit from tools that allow them to obtain results and measurements and pass along relevant health information easier when they give consents.

<sup>1</sup> [http://en.wikipedia.org/wiki/Wikiality#Wikipedia\\_references](http://en.wikipedia.org/wiki/Wikiality#Wikipedia_references)

<sup>11</sup> Various surveys have shown percentages well over 50%

## Collaboration

Collaboration means bringing users together that have not interacted (enough). Not only within a certain user group (such as multiple scientists collaborating) but also across these groups. Allowing patients to be involved with the medical world and vice versa and allowing health professionals to adapt new scientific breakthroughs faster and with guidance.

In terms of the Personal Health Record, one can think of patients that open their PHR up for peers, a form of collaboration that currently is not happening. Especially in regard of some intense experiences such as going through cancer or couples who are busy with IVF (Tuil, 49), experienced peers can feel a strong need to assist 'newcomers' to help them through the process they have already been through.

## Openness

The last theme of Medicine 2.0 is openness. In the IT world openness is a very popular trend, think for instance of open source software and open standards. The main idea behind it is that you are transparent and willing to share knowledge with peers. In fact, there should be a mutual benefit from opening up.

This can be interpreted technically: in Web 2.0 and Medicine 2.0 openness is considered important. If you want to collaborate with others, data should be easy to obtain and transpose. Hence in The Netherlands Nictiz (30) initiated a standard (called AORTA) for connecting health information together in Holland or the NEN-norms from the EU or even the American HL7 standard that state requirements for PHRs. There's currently no consensus or a leading standard yet, but they can all be seen rather overlapping.

### 3.6 Why Medicine 2.0?

Now that we know what it is, what is it good for? What benefits will Medicine 2.0 give to the Dutch healthcare system? Some of these benefits were already somewhat hinted in the previous chapter where Medicine 2.0 got explained and in the chapter discussing why Internet is favorable in healthcare, but in this chapter I will sum the main benefits and possibilities, based on a report on eHealth (20) that M. Heldoorn wrote on behalf of the NPCF<sup>1</sup> and points from the Institute of Medicine (24).

## Better information

Information is important, the more relevant information about patients that can be shared among health professionals, the better they can diagnose. With the arrival of Internet in healthcare, this information can be spread fast and easy. Very important, necessary information will be at the right person at the right moment, allowing a continuous care process.

Also, healthcare professionals can obtain easy and cheaply information regarding best practices, so called transparency. When they combine this best practice information with the personal information about the patient, their treatments can become very specialized / individual and in overall better for the patient. Next to that, Internet technology allows specialist that normally would not have cooperated, cooperate which will lead to innovative healthcare services.

Another benefit is putting information online towards the patients so they are properly informed and instructed when they come for a visit. For instance the guidelines and procedures of a surgery can be communicated in advance.

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<sup>1</sup> Nederlandse Patienten Consumenten Federatie



## Effective care

When taking care of patients, health professionals follow a chain of activities. With the support of Internet these activities can connect better, allowing techniques such as chain management and disease management. Also, the efficiency can be raised, by making sure redundant activities are eliminated with adequate information sharing.

Patients can also perform easy tasks themselves, if instructed properly, thus health professionals have more time for less mundane activities. For instance taking measures is a task that patients can do themselves very easily. Also if the patients record these measurements the necessary administrative tasks performed by the health professional will lower.

Also with the digitalization of certain care activities, healthcare can reach further than just the hospital, allowing possibilities such as getting remote healthcare at home. This improves not only the reach of health professionals, but also improves the accessibility of services.

## Focus on the patient

The supply of healthcare solutions shall grow. The already mentioned remote healthcare can reach beyond borders and new types of health care professionals shall emerge, thanks to better information availability, patients will get to know about these new types and treatments abroad.

Patient empowerment is a very important term that you read almost everywhere when you start looking into Medicine 2.0. Patients need to get more involved with their healthcare. Instead of passively getting information, make them use the information in a social environment. This way information that they hear from their doctor or own experiences can be spread to other patients as well. For instance, if you let a patient keep track of side effects of medication, this could only lead to new information that might be of some use.

Next to that, it allows demand-controlled healthcare, allowing the patients to determine better when he wants his appointments<sup>1</sup> and what demands he has. The patient can manage his treatment himself, known as consumerism. This way the solution will be very demand-specific. When the service gets customized like this, there is also a better continuity as the right specialists can be pulled into the care process at the right time.

## 3.7 Personal Health Records

One answer to offering better information, empowering the patient and raising the effectivity of care are Personal Health Records. The term Personal Health Records was already used a few times whilst explaining Medicine 2.0, but what is a Personal Health Record exactly? On websites of companies that actually already offer PHRs each seem to have their own unique definition, however they all share something in common. When going through scientific papers however usually the definition from the Markle Foundation gets used:

*“an electronic application through which individuals can access, manage, and share their health information in a secure and confidential environment” (26)*

The term ‘individuals’ is purposely used as the usage of the term ‘patient’ would imply illness and obviously one does not necessarily have to be ill to upkeep a PHR; maintaining health and wellness can also be a motivation. Aside from that, it should also be possible to maintain PHRs of relatives (e.g. the elder or children) in case that is necessary.

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<sup>1</sup> For instance what Pink Roccade @pointment currently offers.

Tang et al (46) also refer to the Markle definition in their article, but they also describe the potential use of a Personal Health Record:

*“PHR systems capture health data entered by individuals and provide information related to the care of those individuals. Personal health records include tools to help individuals take a more active role in their own health. In part, PHRs represent a repository for patient data, but PHR systems can also include decision-support capabilities that can assist patients in managing chronic conditions. Most consumers and patients receive care from many health care providers, and consequently their health data are dispersed over many facilities’ paper- and EHR-based record systems. A fragmented system of storing and retrieving essential patient data impedes optimal care.” (46)*

myPHR.com, an initiative by The American Health Information Management Association (AHIMA), who were one of the firsts when it comes to exploring the possibilities of Personal Health Records, informs American citizens about Personal Health Records on this website and they have slightly different definition for PHR that adds details to the user side a bit more:

*“The PHR is a tool for collecting, tracking, and sharing important, up-to-date information about your health or the health of someone in your care. Using a PHR should help you make better health decisions and improve the quality of your care by allowing you to access and use information needed to communicate effectively with others about your healthcare.” (2)*

This definition says effectively the same thing as the Markle Foundation one, however it stresses better that you keep the information up-to-date and that you can manage the PHR of people put in your care. So a PHR can be defined more concise and specific as:

***“A Personal Health Record is a tool to access, collect, track, manage and share actual, up-to-date information(-flows) about your own health or the health of someone in your care in a secure and confidential environment.”***

Personal Health Records introduce the personal part. In line with the need for patient empowerment, a PHR pursues that the patient initiates and maintains his health records in his own personal way. Instead of getting just new information from and via health professionals, the patient actively seeks, combines and personalizes relevant information into his PHR. On the right there is an example of a Personal Health Record, where the patient added a part of information from two EHR sources (e.g. ChipSoft and iMedOne), the information of one of his physicians (D2P) and some experiences of other patients (he met online) which are the P2Ps.

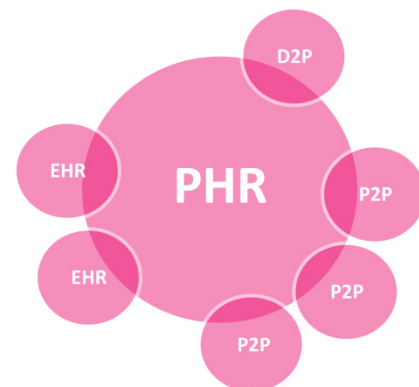


Figure 3.6: Example of the PHR domain

An important nuance is that a PHR is not there to replace an EHR, it is a tool to let patients participate in the healthcare process by using their efforts in finding health information by themselves and keeping their own health statistics more up to date than a health professional could log in the EHR. EHRs and PHRs coexist.

**Tool**

Based on the different choices in the medium, there are various types of PHRs available and possible (2):

Medium	Description
Paper	Basically nothing more but a collection of printed out health records. Users can maintain their records by filling in templates with their favorite text editor or even by hand and when they have to see a health specialist, they print out the relevant documents and carry them along.
Electronic	Users can maintain digital health records using templates and scan in received health documents. Also they can keep them organized and up-to-date on an electronic data carrier, such as a CD-RW or USB stick which they can share with their health professional.
Desktop Application	Instead of working with separate documents, the user can also install an application on his computer where he can organize and keep his health information up-to-date. When going to see a health specialist, the user has various options to share the information, such as printing or emailing the relevant documents.
Online Application	Fairly similar to the desktop application, yet working via the Internet, allowing information to be accessed and shared with much more ease. Instead of working with documents, the health specialist gets certain rights to see certain parts of the Personal Health Record.

Connectivity

Table 3.3: Types of PHRs

Current initiatives in the market (and this research) focus on the latter one, an online application.

The figure on the right shows a tension. Ideally a Personal Health Record gets as much interconnectivity with other sources of information as possible, however as you can see, the more connections a PHR gets, the more complex the technology gets as well. This also applies on the user experience, as the user needs to manage (and understand) all the input from various sources.

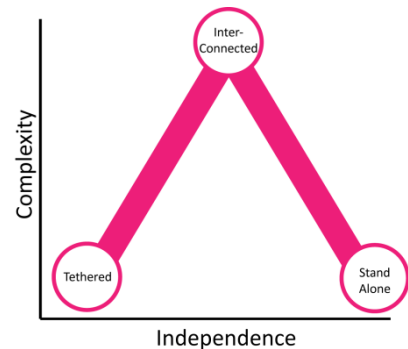


Figure 3.7: connectivity versus complexity

Tang et al about PHRs and interconnectivity versus complexity(46):

*“Ideally, the PHR should include as much relevant data as possible over the individual’s lifetime, from multiple sources, including health care facilities as well as the individual. (...) In order to be useful to the patient, the PHR must present data and accompanying tools in ways that enable the individual to understand and to act on the information contained in the record. This is challenging because of patients’ widely varying levels of general literacy and of health literacy.” (46)*

Another reason why the ‘interconnected’ state is most desired; when patients get to use a stand-alone application it is less likely they keep it up to date but when the PHR is interconnected with other resources of medical data (e.g. an EHR or the Dutch EPD) at least parts can be updated automatically. The tethered form takes it a step further where health information systems are heavily entwined into one other, however this is not always possible and/or favorable.

In the Tang et al (46) article, they state a conclusion from a symposium arranged by the American Medical Informatics Association’s College of Medical Informatics:

*“Although there are specific advantages for each type of PHR, symposium participants concluded that PHRs integrated with EHRs, either through tethering or interconnectivity, provide much greater benefits than stand-alone PHRs. The integrated PHR-EHR approach can convey much more relevant data to the patient.” (46)*

In this research, due to apparent market tendencies, we stick with the online application option and disregard the other alternatives presented. Also, this online application needs to pursue (high) interconnectivity as current information systems in healthcare are not designed for a tethered approach (yet).

## Access

Up until recently, a Dutch patient could not look into his own health records without asking a health care professional in between. However as patients should get more empowerment in their healthcare, his health information should be made available to him and should be easily accessible. For some years the organization Nictiz<sup>1</sup> has been working on the EPD, the Dutch (national) EHR in order to let patients access their health records online and also to connect the information systems of health care organizations better with one other. Obviously a good initiative, however an EHR is not a PHR and experts also wonder if patients should be more involved as it is *their* information.

As the PHR is a Web 2.0 application it means that the information shall be available on the Internet and if the user logs into the system he has access to his or his information and the information of people put in his care. Using the Internet as medium allows the user to access his health information any time, any place.

The definition of PHR ends with 'in a secure and confidential environment', when personal health information is available like this on a public source such as the Internet, it does require good security and a confidential relationship with the service provider, knowing the information does not get into the wrong hands. Health information is very personal and private data and not only is it hard to generate enough trust so that users actually start using your PHR service, you also have to do your best to keep the data safe as one goof is already enough to destroy the trust that much that you're out of business.

## Collect

In a Personal Health Record you want to put as much actual health information as you possibly can. After all, the more relevant information you can share with your health professional, the better for his diagnosis and for you. Hence, the collection of health information is an important part and feature of a PHR. Examples of health information you can put into your PHR (2) are:

- Hospital records;
- Private Practitioner\physician records;
- Treatment\lab results;
- Dental records;
- Psychologist records;
- Medication lists;
- Allergies;
- Family history;
- Personal preferences;
- Emergency information.

**Example:** If you for instance got medication for heart problems, it might be valuable to add the daily measurements of your pulse into your PHR, so that your health professional can see detailed information, perhaps even a chart how your heartbeat responded to the treatment.

## Track and Manage

Once you collected health information, it is important that this information stays up-to-date and relevant. This can happen in two ways, either tracking or managing. Tracking means that you keep adding actual data to your Personal Health Record usually to eventually communicate the progress of a certain treatment.

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<sup>1</sup> Nationaal ICT Instituut in de Zorg (translates to: National ICT Institute in Healthcare)

This tracking can happen manually by logging in to the PHR service and adding new data by hand but steadily more and more health devices can be connected to the Personal Health Records as well. Especially Microsoft is currently experimenting with this feature in their HealthVault application. So for instance, if you get a stent somewhere in your body that regulates hormones, information based on real-time information is streamed to the PHR and can provide a lot of interesting data to the health professional and potentially also others.

The patient also manages his data. Where tracking really pursues keeping data up-to-date and thus creating a chronology of data, managing means you decide which information is relevant to whom. Or differently put: control over the information flows. For instance, your dentist would not really care much that you slept bad for three weeks because your pet turtle died while your psychotherapist would. So it's important you manage this piece of information so that only the professionals who see its relevance gets to see it.

Plus, managing also entails shifting information from one health professional to one other. This will be explained further in the next paragraph at 'indirect D2D'.

## Share

This paragraph will explain the ways information can flow with a PHR. Even though the terms say 'Doctor', it would be better to read that as health care professional as potential actors can be: doctors, hospital specialists, physicians, personal practitioner, pharmacies, dentists, opticians and more options are available as long as they can get access to your Personal Health Record. However the 'Doctor' term is kept as the Doctor2Patient and Patient2Patient terms are already used in the medical world, thus would be more recognizable.

All potential information flows are summed up in table 4:

Connection	Description
Patient2Doctor (P2D)	The data that the patient collects, tracks and manages can be shared with his health professional to provide a better look on the progress and history of the patient his health. To do so the patient has to grant the health professional privileges to relevant information in his PHR.
Doctor2Patient (D2P)	Health professionals keep details about treatment, medication, etc of each patient. With the need for patient empowerment this information can also be put into the PHR of the patient. This way for instance conflicting medication can be spotted and anticipated. This information flow can either be automatic, in the form of an EHR, but also granting health professionals rights to add information to a patient's PHR is an option.
Patient2Patient (P2P)	Patients can also share experiences with one other. This can for instance be in the form of a diary where patients with the same illness can look into each other their PHRs and give moral support and useful information. Or information pages about illnesses that patients maintain themselves, Wikipedia-style. Another common practice of this form would be sharing health information with family members.
Indirect Doctor2Doctor (D2D)	When you see different health professionals, it can easily be the case that there is supplementary or conflicting treatment. So ideally you want to share information about these supplementary or conflicting treatments with the involved health professionals by allowing them to see everyone his new additions. Assuming health professionals interact with each other as well (with EHRs etc), this can work as an indirect way (the patient controls the information flow with his PHR) of transferring knowledge in between health professionals.
Patient2Researcher (P2R)	Obtaining medical data for research is hard, however when patients keep PHRs a lot of medical data is in a digital form available. Therefore it would be great for medical research <sup>1</sup> if researchers could get access to this available data if the patient allows so and if the data can be deidentified.

Table 3.4: Types of information flows

<sup>1</sup> With the slight nuance that the validity can be a lot weaker because test subjects provide the data themselves

The P2P sharing is what Eysenbach (14) likes to address to as PHR 2.0, it introduces the strength of web 2.0, the 'social element' to information.

### 'The Social element'

Eysenbach observed that that in any E-health trial a substantial proportion of users drop out before completion or stop using the application (13). In his article on this so called 'Law of Attrition', he gives many examples where the number of active users significantly drops to drastic percentages (like only 1% of the user base left after a year) and also states the interest and usage drops over time as well at the users that remain using the application. According to Eysenbach this is reversed innovation diffusion. (13) Regular innovation diffusion got introduced by Rogers, being:

*"Diffusion is the process by which an innovation is communicated through certain channels over time among members of a social system". (8)*

Reversed innovation diffusion works the other way, the innovation gets (properly) communicated among members of a social system and they start to use it, however the evaluation of the innovation happens during usage and they realize they do not want the service after all. However, current young Internet users use social networking websites vividly therefore Eysenbach brought up the question that if an E-health application gets the proper social incentives, the law of attrition can be put to a halt.

Sarahsohn-Kahn (39) writes about the power of collective wisdom, the more users, the more valuable the network (diversity, aggregation, etc.) and application in this case. In network theory this rule is known as Metcalfe's law<sup>1</sup>. Especially for the potential patient2patient relationships this law is very relevant of course: the more users (n), the more potential relationships ( $n^2-1$ ) are available. The patient2patient possibility can be seen as a way to introduce social networking into a Personal Health Record.

### 'The legacy of disconnected information'

Another problem that the medical world is facing that it is hard to restore the medical history of a patient. What currently goes on in the Netherlands is that a lot of medical data is scattered over several (disconnected) systems and plenty of the data is not even available in a digital form but actually kept on paper. When this medical information gets retrieved and combined (preferably via interconnectivity or initiated by the patient himself), it creates a more complete chronology about a patient his medical history.

### Benefits of a Personal Health Record

To sum it up, a PHR offers the following benefits (Tang et al; 46):

- Greater access to wide array of credible health information, data and knowledge;
- Patients can manage and customize this data to make it more useful;
- Patients with chronic illnesses can track their disease, allowing more adequate interaction with the health professional;
- Collaborative illness tracking can lower patient-health professional communicative barriers;
- Improved communication allows better appointments, problem-handling, in-depth questions etc;
- For the health professional, a PHR should facilitate the caretaking, making it easier;
- The health professional has an ongoing, continuous connection with his patient;
- Health professionals can get insights in other relevant medical data via the patient;
- Patients get triggered to play a more active role in their treatment, communicating with peers and taking over the mundane (communicative) tasks of health professionals;
- For health insurance companies etc, the PHR is likely to drop many costs, such as costs for disease management and wellness programs.

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<sup>1</sup> [http://en.wikipedia.org/wiki/Metcalfe%27s\\_law](http://en.wikipedia.org/wiki/Metcalfe%27s_law)

### 3.8 What PHR products are already around?

Several Personal Health Records already emerged on the market. There is currently no dominant player in the market yet so several companies take their chances. Instead of reinventing the wheel it is always good to look at what others offer therefore this chapter shall give a few examples of these offers and a subjective impression. In this research the examined PHRs are limited to Google Health, Microsoft's HealthVault and ICW's Lifesensor. These are suggested by internal experts as the three most interesting PHR initiatives for the current Dutch market and they all three have a different approach to the product as well.

Except for Google Health, all these PHRs are more than just an interface to Personal Health Records, but more a health (web)portal. Portals present information from diverse sources in a unified way. This choice to add extra information and features to the PHR service (i.e. making it a health portal) is done deliberately to make the service more versatile and more appealing to the users.

The following chapters contain a brief assessment on the features, interconnectivity, revenue model, privacy and security, social elements and other noteworthy remarks of each of these PHRs.

#### Google Health

Google Health is an application that since May 2008 went public after a pilot in Cleveland. Its main feature is keeping a Personal Health Record, based on the CCR API (an American standard). It is an opt-in service, so users can volunteer to use it. Also, users get the option to either transfer medical information from partners for a fee (US only at the moment) or manually put medical information into their PHR. The information is about health conditions, medications, allergies and lab results.

Inside the application you can look for health organizations and professionals. With the information in your PHR Google provides the user with a merged health record, background information on 'popular' conditions, and possible interactions between drugs, conditions, and allergies. Multiple profiles are possible so when you e.g. want to keep a medical record of your child or grandfather it is possible.

Users can share their profile with other people and export information via third parties into official documents. Recently Google also added support to open up your profile for family, friends and other people in the Google community.

Privacy and security is handled by using the Google account that works for all Google applications (Gmail, iGoogle, Google Maps etc). Google makes several privacy claims in their policies, however they are not affiliated with any regulating organization (such as HIPAA) which makes certain experts skeptical about their privacy. After all, there has to be a catch for Google to offer such a product.

*"Google does not sell health data. In fact, one of our most steadfast privacy principles is that we don't sell our users' personal data, whether it's stored in Google Health, Gmail, or in any of our products. And from a policy perspective, we oppose the sale of medical information in the health care industry." (18)*

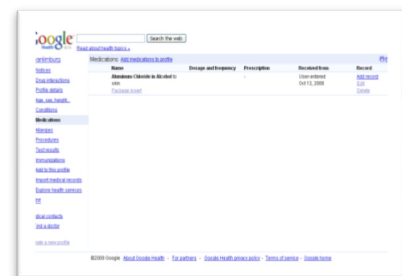


Figure 3.8: Google Health

The revenue model for Google Health is arbitrary up until now, Google leaves Google Health 'ads-free' for the time being, but implied that putting advertisement on the website might be an option eventually. Obviously there are other non-monetary gains from this service such as branding and more importantly, knowing even more about their customers to customize the advertisement provided with Google AdSense, as even though Google claims not to *sell* the information, what they do themselves with the content of Google Health remains unclear but they can data mine the information to understand more of their customers<sup>1</sup>.

Google tries to get Google Health into the healthcare market by motivating hospitals (or health professionals in that sense) to use it. Their pilot was in cooperation with Cleveland Hospital and they seem to continue keeping their focus on hospitals. Their view is that in order for a PHR to be successful, health professionals need to be open-minded and supportive to integrate a PHR into their processes therefore Google tries to get them onboard.

A slightly subjective judgment but compared to the other PHRs the interface is very no-nonsense which makes it very straight-forward but barren and not really appealing to use.

## MS HealthVault

The PHR initiative by Microsoft is called HealthVault and it is a platform where customers can store and maintain health and fitness information. The usage of the word 'platform' already shows why it is a bit different to Google Health. HealthVault can better be seen as a PHR platform with a set of back-end services for secure storage, retrieval and sharing of healthcare information. Other companies can use this platform to develop a "classic PHR"<sup>11</sup> and possibly also other health applications. An expert describes it as an operating system, just like Windows Microsoft delivers a platform and third parties write the real applications. The presence of 'drivers' is another thing HealthVault stands out with, this way there is a possibility to stream medical data from devices to the platform without any manual intervention needed.

The platform is focused on Live Health Search, a searching tool for health and wellbeing topics. One can look for information on certain conditions and see a mosaic of information. The second part is the Personal Health Record, where multiple health records and other forms of digital information can be maintained by the customer.

Another important aspect are the wellbeing services that get offered on the front page. They take up a lot of space at least. There are a lot of third party solutions for trainings to lose weight, exercise more, stop smoking and similar activities and most likely part of the revenue model by either charging advertisement costs or revenue sharing.

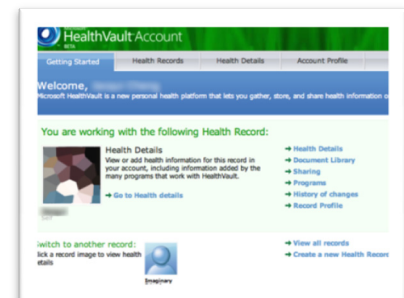


Figure 3.9: Microsoft HealthVault

Just like with Google Health they offer several possibilities to transfer medical information into the Personal Health Record. So far, the PHR part of HealthVault is US only so it could not be tested personally but judging screenshots, they show the same tabs as Google Health and Lifesensor, so conditions, medication, allergies and lab results can be maintained.

Privacy and security is handled with Microsoft their Live ID, an ID that can be used for all of Microsoft their online services such as Hotmail, MSN, etc.

Revenues are based on placed advertisement for healthcare or wellbeing products and services (especially medical home technology), possibly involving revenue sharing as well. When using the search facilities more advertisements appear on the Live Search service.

<sup>1</sup> They do this with other private information such as content on Gmail and Google Docs as well

<sup>11</sup> <http://clinicore.blogspot.com/2007/10/understanding-how-to-develop.html>



Also, Microsoft is currently attempting to make exclusive deals with insurance companies in the US<sup>1</sup> to expand their market.

### ICW Lifesensor

Lifesensor is an European initiative for a PHR by the German InterComponentWare (ICW) and is designed for five target customers: customers (i.e. patients), employers (possibilities for offering wellbeing activities and monitoring of their employees), payers, providers and hospitals.

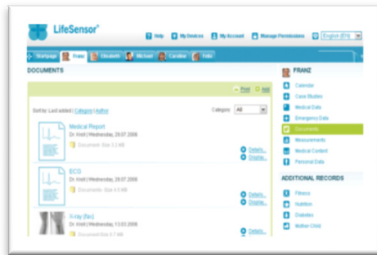


Figure 3.10: ICW Lifesensor

Lifesensor is more than a PHR, it is a whole healthcare portal or perhaps better put: a whole healthcare suite that offers a spectrum of tools such as an appointment manager, medical address book, emergency information and a lot more. Compared to the other two PHRs it is the most versatile and complete healthcare solution.

As for the PHR part, it offers the same tabs as the previous two PHRs so *it offers the possibility to add conditions, medications, etc.* The sharing and social element with Lifesensor is very noticeable. A user can manage access rights to each record, allowing friends, family and/or professionals to look into his PHR for a period of time or infinitely.

Privacy and protection is handled with a user plus password which you will get once you subscribed to the service.

Lifesensor is also different in the way it makes revenues. They do not use any form of advertisement but work with an annual subscription fee of \$60 per user.

It remains unclear how the medical information gets into the PHR, judging that they do not offer any 3<sup>rd</sup> party services to transfer medical information into the PHR. For such a pricy solution, one would expect automatic integration within information sources.

### Conclusion

One can see that in the various PHR products that were examined here, there are big differences in philosophy especially regarding how to create revenues with them and how to present the PHR to the market. For instance, Google Health prefers a minimalistic approach while Lifesensor offers an application that also allows users to make appointments. And Microsoft seems to offer a PHR framework solution for third parties to exploit.

These differences proof that there is not one clear best practice but that there are multiple options and opportunities that can be taken into consideration by the management.

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<sup>1</sup> <http://arstechnica.com/microsoft/news/2008/10/microsoft-healthvault-scores-with-aetna-e-records-pact.ars>

# 4. Who is the market?

## 4.1 Who are the interested parties?

Cain and Mittman (8) give a list of all the stakeholders when introducing a new technology into the realm of healthcare, between brackets the relevant actors in context of this research are mentioned:

- Patients (i.e. users of the PHR)
- Healthcare provider (i.e. health professionals, CDOs)
- Payer (i.e. health insurance companies)
- Vendor (i.e. application service provider)
- Policymakers (i.e. national and European government)



Figure 4.1: Interested parties

## 4.2 Patients

There is a growing need among patients to get more informed and more involved in their care processes, if they see a doctor, they want to be properly informed and make decisions themselves. A PHR can help herein by being a tool to improve the information flows and to help patients with making their decisions. For instance, due to hassle a patient would feel less tempted to see a specialist in Canada or Egypt, mainly because they are ill-informed about the possibilities on one hand and the difficulties regarding information barriers. With a PHR a patient can create a (even temporary) network around him involving all the relevant doctors, specialists and what not required for a specific treatment, regardless nationalities or even technological barriers. One could compare it with Internet banking, even though you could do it on paper and by visiting the bank, most people enjoy the luxury to do it from the couch at home in their own time.

Patients are the central actor in the Personal Health Record service; they are the main hub within their personal health information networks. After all, patients are responsible for generating and managing the content and with it making the PHR valuable to themselves and to others, such as health professionals and peers. In other words the contribution and involvement of the patient makes or breaks the service.

Adoption to innovation happens via the S-Curve, first introduced by Rogers (8). Innovations spread through populations in five phases: the innovators (2,5%), early adopters (13,5%), early majority (34%), late majority (34%) and the laggards (16%).

It is hard to find usage percentages for Personal Health Records as it is a fairly new product. On the Internet there are some quotes from Dunbrack, who did research in the use of EHRs and PHRs in America (who are ahead of the rest):

*“As Lynne Dunbrack, program director at Health Industry Insights, a market research and advisory services firm told PC World last October, these providers are banking on a significant growth in the 30 per cent of US doctors and hospitals that currently use electronic health records, or there just won't be enough electronic data to populate these personal e-health records.*

*And, as Dunbrack further explained, in spite of the major push from president Bush and several private groups, fewer than 3 per cent of US consumers have adopted personal e-health records.”<sup>1</sup>*

<sup>1</sup> <http://www.medicalnewstoday.com/articles/108205.php>

This statement was put when Google Health got introduced publically and before HealthVault appeared so in the last year the percentages could have increased a bit.

More recent figures from Deloitte<sup>1</sup> show that in the US 42% of the patients would consider using a PHR and currently 9% are actually using them. So that is a 6% growth in one year when compared to the figures Dunbrack found.

According to a study by Tuil (49) among IVF patients almost 79% of the users of the experimental IVF-poli found the preliminary Personal Health Record very useful and a nice enrichment onto the service, however as this study focuses on IVF alone it is hard to say if these figures reflect a more general audience. It proves that for chronic illnesses and radical treatments patients desire empowerment and being in the loop as much as possible.

It is always interesting to see what numbers we are talking about, so when taking The Netherlands into account (based on CBS figures from 2005<sup>II</sup>): 80% of the Dutch population actually uses the Internet<sup>III</sup>, of which 50% uses Internet for health related activities. This would imply a potential Internet-based healthcare market of about 6,5 million people or in other words: 40% of the Dutch people could be interested in using E-Health applications. ('Raad van Volksgezondheid', used the same calculus determining the CBS figures from 2002 to assess the size of the Dutch E-health market)

Also, according to the 'Raad van Volksgezondheid', Internet usage is correlated with intelligence and income. People with a high intelligence and/or high income use the Internet more frequent and intensive than others. People with a high intelligence are also known to be more active and aware with their well-being and health.

**As a reference:** the currently biggest social networking website in The Netherlands is Hyves.

Hyves has roughly 5,5 million Dutch users halfway last year. They have almost 41% of the Dutch Internet market and mostly the younger generation, aka. generation Y (under 35yo).

Unconfirmed estimates are that they have about 25 million euro a year of revenues.

## Innovation diffusion

Cain and Mittman (8) suggest 10 critical dynamics of innovation diffusion:

Dynamic	Description	CSFs
Relative advantage	Users need to see the real benefit of swapping to the new innovation.	Understand the end user of the technology. Recognize the impact of significant behavior. Consider the business case for the adoption of a new technology.
Trialability	In order to assess the benefit, users want to try the innovation first without commitment and many investments.	Look for opportunities to carve out some part of a system that is more triable. When designing a complex new technology or system, think about which components of it could be tried out without committing to the full innovation.
Observability	Also to assess the benefit, users like to see others use it before using it themselves.	Make the invisible visible with viral marketing.

<sup>1</sup> <http://www.healthcareitnews.com/news/consumer-demand-healthcare-it-never-stronger-survey-shows>

<sup>II</sup> <http://www.cbs.nl/nr/exeres/5D629109-4E7F-48E1-A2A5-CD3CD88EFD1.htm>

<sup>III</sup> In the 16-35 age range this figure even lies close to 100%!

Communication channels	In order to create positive network externalities users need to be able to communicate and be reached.	To inform people about innovation, select mass media and "cosmopolite" sources.
		To persuade people to adopt the innovation, closer links and interpersonal channels are more effective.
		To communicate more complex messages, select interpersonal communication channels.
		In order to select the right communication channels, select the right target audience.
		Identify individuals who are "Connectors".
Homogeneous groups	Groups with similar characteristics diffuse easier than heterogeneous groups.	Use homogeneity as a technology promoter; understand the degree of homogeneity in the target group.
		Look for other homogeneous groups beyond your initial target group.
		Put the right person in front of your target audience.
Pace of innovation / reinvention	The evolution of the innovation affects the diffusion. The degree of reinvention of any innovation affects both its pace and style of diffusion.	Put active listening posts in place.
		Monitor medical technologies carefully to avoid misuse.
		Look for 'workarounds' that users employ when using the technology.
		Do not be offended by reinvention.
Norms, roles and social network	These affect the pace how an innovation spreads.	Pay explicit attention to the physical and virtual networks of the groups you wish to reach.
		Be aware of opportunities to leverage existing or create new social networks.
Opinion leaders	Key actors that like the innovation can act as change agents and enforce the diffusion.	Do not mistake early adopters for opinion leaders.
		Work hard to identify the relevant opinion leaders.
		Be on the lookout for 'Mavens'.
Compatibility	The familiarity and compatibility of the innovation with the environment, speeds up the diffusion process.	Understand current behaviors and values.
		Innovations that reduce hassles are more likely to be successful.
		Mimic things from other parts of life.
Infrastructure	The diffusion relies on already existing infrastructure.	Look for opportunities to plug and play.
		Understand current and future regulatory constraints and competing patent protections.
		Look for leapfrogging technology.

Table 4.1: CSFs of innovation diffusion

The above innovation diffusion Critical Success Factors are important facets to take into consideration when introducing Personal Health Records into the Dutch market and have influence on the marketing mostly.

### Patient needs

NPCF state patients needs for E-Health applications in their vision report, based on previous research (20):

Needs	Description
Adequate information	Patients want optimal information about their health status, treatment and reliable information about illnesses and health.
Adequate care supply	There should be enough qualitative supply of care so that patients can assess these qualities and have the ability to choose options.

Adequate access	24/7 access to health information, easily accessible services and the ability to use Internet for asking questions and making appointments.
Adequate care	Healthcare professionals need be optimally informed about the health status of their patient, therefore the patient expects information gets communicated among these professionals.
Adequate security	Privacy regarding medical information is considered very important.
Support	In order to use the application properly, patients have to rely on support and adequate information.
Usability	Different kinds of patients need to be able to use the application.

Table 4.2: Patient needs according to NPCF

Experts confirm that the main interest of patients on the Internet is to obtain adequate, reliable information regarding their health. The findings by Sarahsohn-Kahn (39) also confirm this when specifically looking at the social activities that patients perform on the web. Strangely adequate security show ambiguous results. Researchers state that patients consider security highly important, yet, with a pilot program of making appointments with an online application, Pink Roccade Healthcare discovered that the usage dropped when the security increased. The login processes probably made the service too much of a hassle for patients and they decided not to use it.

Based on these needs the NPCF formed Critical Success Factors regarding the patient needs (20) for an Electronic Health Record. Much of these CSFs also have a familiar ring as they reflect the vision of the future of healthcare, as e.g. Medicine 2.0 describes.

CSF	Description
Unrestricted access	Patients should get unrestricted access to their own medical information.
Transparency	In order to make decisions, patients should get to see all the relevant information so they can make the righteous decisions, obviously this information needs to be made available for the patient.
Safety	Risks should be minimized to guarantee a patient his safety and that no harm can be done.
Norms	Existing norms should be taken into account to guarantee transferability, interconnectivity and proper data storage.
Interoperationality	Not only interconnectivity is a must, also cooperation regarding involved organizations and people is a part of that. Thus, there needs to be unity in the communication, also and especially towards the patient.
Patient as administrator	Patients should be triggered to make decisions themselves regarding their health and also make the decisions with whom they want to share their medical information.
24/7 care	Patients should be able to use a healthcare service any time (s)he wants.
Tailor-made care	Besides looking at what patients as a whole want, it is also important there is a personalization twist to it, where a patient can pursue his own personal preferences and choices.
Evidence-based decisions	To guarantee safety and that the patient can make adequate decisions regarding his health, the information he receives should allow him to make the right decision, based on the best and most actual medical knowledge.
Demand-driven development	Patient should be involved with developments of the application to improve it, not only during, but also before development takes place.
Integration	In order to reach patients as much as possible, the application needs to fit into currently available, common technology.

Table 4.3: Patient critical factors according to NPCF

### Maslovian healthcare needs

Maslow his Hierarchy of Human Needs, published in 1943, explains the psychology of motivation. In IBM their research into E-health (22), the Maslovian model was transposed to healthcare:

Personal Health Records can be placed into the optimal health segment of the above pyramid, as it allows patients to work in a holistic, personalized way with their well-being. The pyramid shape has the implication that optimal health is at the highest level, thus all the other needs have a psychologically speaking bigger importance. Hence it is harder to communicate the benefits of a PHR plus people rather spend their time and money on a need from a level underneath. For example, a patient would still rather have cheaper medication or minimized waiting lists than the opportunity to personalize his health process. On a side note, as environmental and basic healthcare needs are properly facilitated in (most) developed countries, they turn rather mundane, taken for granted and the need gets leveled out, so more focus goes towards the three top segments.

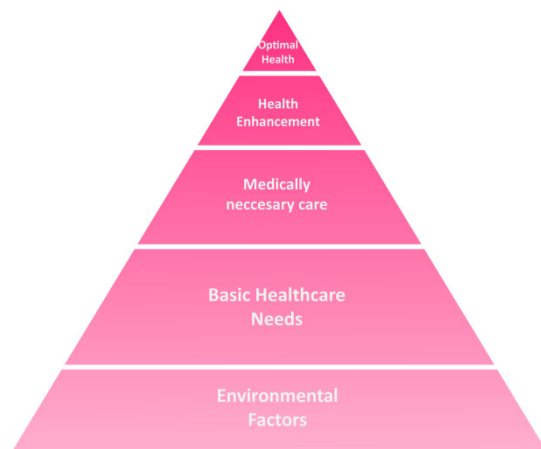


Figure 4.2: Maslovian pyramid for healthcare

This does introduce an important aspect that experts also addressed: when introducing a PHR, the general audience would not directly see a huge benefit for it, which is even intensified by the structure of the Dutch healthcare system where the money flows are controlled by the health insurance companies and patients generally just pay a monthly fee.

### Patient his E-health literacy

When a patient gets to use a Personal Health Record obviously this person needs to be able to grasp what he sees. Norman introduced the E-health literacy lily model (31), a model that shows six facets of literacy that a patient comes across when using E-Health.

Literacy	Description
Traditional	Basic skills like reading, understanding text and speaking\writing understandable.
Information	Knowing potential information sources, the skills to search for them and the ability to filter the results to relevant information.
Media	Being able to place information in a social\political context and assessing how a message is conveyed.
Health	The skills to interact with the health system and being engaged in appropriate self-care.
Computer	The ability to use the computer to solve problems.
Scientific	Placing health research into scientific context, so understanding how scientific processes go and knowing the opportunities and limitations of research.

Table 4.4: Patient E-Health literacies

When combining these literacies with Eysenbach his idea of apomediation, one can see that apomediation can facilitate regarding *solving the illiteracy* of information, media, health and scientific, by transforming the content in such a way the patient can grasp it or make use of it somehow. Traditional and computer literacy shall be a form of literacy that is hard to influence from a web 2.0 application perspective as they are two mandatory requirements.

Illiteracy regarding health subjects should not be taken lightly. E.g. when using Google Health, who knows what “Takayasu’s Thyroiditis” actually is? Or practical issues such as the ability to describe symptoms spot on instead of vague classifications like “my heartbeat is being funny”. When you put medical information in the hands of patients, they should know what they are reading at least.

## Social online health activity

Sarahsohn-Kahn researched what social activities a consumer performs on the Internet, regarding his health. (39) This list is a good indication for which social purposes a Personal Health Record will be used.

Activity	%
To see what other consumers say about medication or treatment	36% <sup>1</sup>
To research other consumers' knowledge and experiences	31%
To learn skills or get education that helps me manage a condition	27%
To get emotional support	17%
To build awareness around a disease or cause	15%
To share my knowledge of and experiences with a medication or treatment	14%
To share my knowledge of and experiences with a health issue	14%
To find consumer's recommendations and opinions about hospitals & other treatment options	13%
To find consumer's recommendations and opinions about hospitals & other treatment centers	13%
To find consumer's recommendations and opinions about doctors	10%
To feel I belong to a group or community	8%
None of the above \ other activities	22%

Table 4.5: Social online health activities

This list shows that the main interest lies in finding information from peers, their experiences and reviews. Interestingly, the eagerness to share these experiences and reviews themselves is a bit less<sup>11</sup>. However, a social element in a Personal Health Record indeed is something people would appreciate.

### 4.3 Healthcare provider

Considering the projected 'doom scenario', the current Dutch healthcare system has to adapt to anticipate future problems and healthcare organizations are well aware that things need to change. However at the same time healthcare organizations are -compared to other sectors- generally a bit more traditional, reluctant and slower when it comes to innovation, mostly due to heaps of legislations, safety rules and complex declaration bureaucracy. (10) Experts claim that the current declaration system (which is about 80% of the total budget of a hospital) does not trigger hospitals to work more efficiently or seek for costs lowering innovations.

Under healthcare providers we classify so called Care Delivery Organizations on one hand, being the aforementioned hospitals, mental aid institutions, care organizations, etc, but also small practices such as a GP or dentist and other clinicians can in this context be seen as a healthcare organization. In the context of this research there is no real need to make the distinction specifically as they all can integrate a PHR in their processes.

The healthcare system has six aims of improvement built around the core needs of healthcare that both the patients and the healthcare organizations agree on (24) and these aims apply for every actor in the health care system but obviously target the healthcare organizations the most. The six areas of improvement are:

Area	Description
Safety	Avoiding injuries to patients from the care that is intended to help them.
Effectiveness	Providing services based on scientific knowledge to all who could benefit and refraining from providing services to those not likely to benefit.
Patient-centeredness	Providing care that is respectful of and responsive to individual patient preferences, needs, and values, and ensuring that patient values guide all clinical decisions.

<sup>1</sup> So read this as: 36% of the total responders, etc.

<sup>11</sup> In line with other Social Media figures that say in between 10 to 20% of the Social Media users are really contributive themselves; when focusing on solely the younger generation these figures are higher though

Timeliness	Reducing waits and sometimes harmful delays for both those who receive and those who give care.
Efficiency	Avoiding waste, including waste of equipment, supplies, ideas, and energy.
Equitability	Providing care that does not vary in quality because of personal characteristics such as gender, ethnicity, geographic location and socioeconomic status.

Table 4.6: Six aims that health organizations need to continuously improve

These vanguards have implications for the Personal Health Record. A PHR especially is helpful regarding the patient-centeredness of healthcare and affecting the effectiveness, efficiency and timeliness of the care process. Safety is an important factor too and should be taken into account; if a patient gets to do more by himself in the care process extra safety measures should be built in (automatic checking of conflicting medication could be an example of that). Equitability can be assessed by the patient himself by reading about other patients their experiences regarding certain treatments and doctors.

The most important thing is to communicate how healthcare professionals and healthcare organizations can benefit from the new service, in other words, informing them about the relative advantage. According to Tang (46), health professionals can benefit from PHRs because patients can supply and combine additional information that can improve the diagnosis of the professional. For instance, an expert said that a patient remembers about 20% of the diagnosis (of which 10% is even inaccurate or wrongly interpreted!) so providing a summary or even a video recording of the diagnosis in a PHR would allow the patient to get better informed. This provided additional information can also help tackling problems due to asynchronous information, because the PHR creates a temporary small network around the patient for that particular treatment. Also Tang claims that patients get more involved in the health process, they also become more actively participative.

Spil conducted 22 interviews with specialists for his USE-IT analysis of EPRs (44). The USE-IT analysis per se is beyond the scope of this research but in his research Spil sums up what the current (information) needs are at specialists. These needs are also valid for Personal Health Records, as they are just a special form of EPR.

Specialists always see patients who are referred to them by either general practitioners or fellow-specialists. This means there is a medical history for each patient already present. The GP or fellow-specialists already went through a diagnosis and perhaps also already received some treatment. All this is medical history and should be recorded in a medical record as a specialist would like to be able to read this too; especially diagnostic results and actual data is very important for specialists. Nowadays information gets mostly shared via telephone or letter but often additional questions need to be asked to the patient to fill up certain information gaps with the danger of (wrong) interpretation of the patient and/or miscommunication. Even internally (so within a hospital for instance) most information systems are not even integrated, for instance patient-in and patient-out records coexist separately and every specialist keeps his own files.

The charts on the right shows what requirements the health care professionals have for information: Especially integration of information and the actuality of information score very high. Because patients often visit multiple healthcare professionals, it is important that all relevant information gets shared, which currently is hardly the case. Another aspect is the actuality; specialists want to see the most up-to-date results to form an optimal diagnosis. Communication between specialists and towards the patient and standardization of information are relatively of less importance, probably because the significance of these activities will decrease when the first two requirements are met. Strangely time efficiency scores relatively low as well, but improving time efficiency is generally considered an important advantage of using of EHRs/PHRs. Time efficiency should not get worse obviously otherwise it is unlikely that specialists will use it.

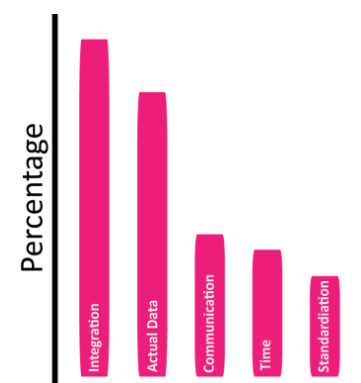


Figure 4.3: Information needs of health care professionals



In an oration(9) Canoy refers to a research that discovered that better integration and better information sharing in the primary processes of health professionals can result in 20-40% cost reduction and 10-40% quality improvement. The first percentage should be very interesting for the health insurance companies as they are the ones who actually pay for the health care expenses. The second percentage should be quite interesting for the health professionals as they can offer a better service to their patients. Canoy also says that by better integrating the data, more (mundane) processes can be taken care of exclusively in the first line.

A PHR can be a tool to make better integration happen. It can be the missing link between two information sources and the patient takes care of the connection (so it is patient-centered) and the patient maintains the information to keep the information actual for the treatment. Next to that the PHR allows specialists to communicate indirectly with each other by supplying the patient with information that is of value for other specialists. This integration aspect is a very strong point of a PHR and sometimes gets overlooked by PHR experts who rather depict a PHR as a patient-controlled 'card box' containing health records while the *sharing* of information and controlling the *information flows* is as important as the data in the PHR.

The points of innovation diffusion that were mentioned at the patients are also relevant for specialists, GPs and other health professionals that will get access to the PHR. They *also* need to adapt to the new innovation and embrace it into their daily routines and that will not happen out of the blue. Hence health professionals need to get informed what benefits the PHR will offer for them, otherwise there is useless for patients to keep all the personalized data if the health professional does not incorporate the service into his processes. Experts say this step is tough due to legislations and current structures and some even project that the problems first may have to intensify even more before health professionals are really pushed to seek for alternatives.

#### 4.4 Health Insurance Companies

The health insurance companies pay for the public health care every patient receives, so they mostly care about finances and offering their clients affordable, good quality healthcare. In 2006 a new health care system was introduced to increase competition between health insurance companies with the goal to force them to make tighter deals with hospitals and other CDOs to offer the best services for the best price. This is only the first step though, there also needs to be a shift from a short-term to a long-term vision. So, not only offer a good solution for a good price, but also a holistic view on prolonging the well-being of their customers (on a personal basis) over a longer time and, as an expert hinted, perhaps even create tailor-made policies and contributions based on the lifestyle of each client individually. For instance, many health insurance companies are already cooperating with sport centers.

It is obvious to anticipate that the organizations that pay for the care want the costs to correspond with the quality of the service and the processes to be efficient. The network with healthcare organizations and coalesced deals is important. One can expect a tension between optimal care and optimal costs yet both parties agree that the customer should have the focus. A Personal Health Record can be a good option to reduce costs. For example, a patient can log certain blood levels for two weeks without having to see the doctor vis-à-vis so instead of for instance three visits (before-during-after), a patient only has to visit the doctor twice (before-after). For the one who is paying that is already a 33% costs cut!

A PHR can also be used in the personalization process that the health insurance companies want to achieve in the future as they want to move from a reactive to a preventive approach. Another good point where a PHR can help is aiding in the information flows in between specialists anywhere, for insurance companies this is fairly interesting as they can offer e.g. eye laser treatments in Egypt or similar treatments for a cheaper deal than local options, a patient can be informed with this solution and he can decide to go for it or not.

## 4.5 Vendor

Opportunities arise from the problems in the current Dutch health care market. The bad information sharing, the rising costs, the growing demand and the stagnating supply, all these problems add up to value creation opportunities for E-Health companies to offer a service to solve at least one of these problems.

The Personal Health Record, in ideal form, could solve many of the problems that the Dutch healthcare market is facing and will face in an even worse condition in the future. Therefore vendors see a PHR as a good opportunity to make revenues and some parties already started offering a PHR solution to the Dutch healthcare/E-Health market.

### Total Customer Experience

The Total Customer Experience (TCE) encompasses all stages of a customer his interaction with an E-Commerce environment, so the whole purchase experience that influences customer satisfaction and perception of value (in this case the quality of the service). Next to creating value (i.e. offering the service) creating a positive TCE is equally important in order to acquire more customers and retain customers, especially considering the "Law of Attrition" that Eysenbach (13) warns about. Therefore E-Commerce environments need to provide and maintain the value proposition continuously to build up customer loyalty and reduce the churn rate.

There is a tension between the actual service that a customer gets and what service a customer expects to get. If the actual service is as expected or even better than expected this shall obviously make the customer satisfied and willing to come back. If the service is rubbish, he will not use the service anymore and look for alternatives.

The e-SERVQUAL framework (based on Parasuraman his SERVQUAL framework but translated to Internet services) offers ten heuristics of customers' expectations and perceptions (30). In the following table these heuristics are mentioned and slightly altered to fit the Personal Health Record context:

Heuristic	Description
Reliability	Consistently and accurately deliver the level of promised service every time.
Responsiveness	The speed with which the organization responds to customers' queries, informs them, responds to their complaints, etc.
Customer services	Willingness to help customers; efficiency, knowledge and courtesy of employees and their ability to inspire trust and confidence; empathy, caring, individualized attention provided to customers.
Access	The ease and speed of accessing the website.
Credibility	The trustworthiness of the organization; the brand image.
Privacy \ Security	The security of the transaction and privacy of customer-related information.
One-to-one marketing \ Personalization	Personalization of the marketing experience. The personalized experience involves proposing customized health services and incentives.
Information content	Accuracy, completeness, clarity, timeliness of the service.
Customers in control	Customers are in control of their personal information. They can track their transactions and make their own decisions.
People issues	Building an image of giving something back to the community.

Table 4.7: Heuristics of E-service

The e-SERVQUAL looks from the organization perspective but it shows parallels with the patients needs earlier addressed in this research. This is logically because as an organization you want to deliver a service that serves the customer needs best.

## 4.6 Policymakers

There are still no strict standards in Europe regarding legislations on PHRs as there is no clarity or unanimity yet, so juridical speaking there is still a lot unclear. However there are a few documents that give a good insight in the legislations and formalities that PHRs entail, however they are not binding:

Legislation	Description
CCHIT	CCHIT released a list certification criteria for functional and technical aspects of a Personal Health Record and it shows a way to classify the functions and features of a PHR.
NEN	There are a few NEN norms that involve PHRs (7510, 13606) , these rules are European standards to guarantee normalization and standardization of security and health records.
XIS	When extracting information from LSP to put in the PHR, there are several requirements that need to be met. Nictiz released a document that contains these requirements to guarantee that the XIS is of enough quality, the so called GBZ. Considering the fact the PHR will not <i>add</i> information to the national EPD or <i>any</i> EHR, it is debatable though if these criteria should be met fully.

Table 4.8: List of legislations around PHRs

## 4.7 Who is the biggest stakeholder?

Tang suggests in his article on PHRs (46) that the government can play an important role in increasing the use of Personal Health Records. Especially at the infrastructure level, the government can take efforts in introducing standards. Early initiatives with these standards is actually what they did with the arrival of the LSP<sup>1</sup> to make information flow, but the LSP targeted health care professionals initially and therefore other efforts to involve the patient as well still need to be explored.

Tang offers a number of legislative actions that would promote the usage of PHRs, however as the Dutch healthcare system is not privatized as the American healthcare system so it is better to also put the promotional efforts at the health insurance providers (the payers) and not just the government.

Patients need an incentive to start using PHRs and especially monetary incentives tend to work best, e.g. the controversial organ donor policy. The same trick (fee reduction) can also work for persuading people to start using PHRs. However PHRs can cause cost reductions and higher efficiency at the health care providers, therefore making the payers pay less to health professionals, so this fee reduction would not cause extra costs. If the providers can be convinced well enough about these benefits then they surely can play a big role in the introduction of Personal Health Records by allowing their customers to use a PHR and integrate it with their health care policies.

## 4.8 Where can the money come from?

Tang (46) states that it is crucial for a business case to understand where the money can come from but that so far little research has been put into this area to give useful evidence into the rationale of payers of PHRs. In general little research has been conducted into this area of Personal Health Records.

Looking at the actors involved, there are these possibilities:

Actor	Possibilities
Patients	<p>Around the same time that Tang his research got published, Adler published an evaluation of the readiness and willingness of patients to pay for online health applications (1). He concludes that two out of three patients are willing to pay a small fee (max. \$20) to use online services.</p> <p>The situation in Holland is slightly different though, as the USA is far more privatized and patients have to pay for services themselves while in Holland patients expect the health insurance companies to take financial responsibilities.</p>

<sup>1</sup> Landelijk Schakel Punt (translated: National Connection Point)

	<p>Another form of generating revenues from the users is so called E-Commerce that emerged from commercial activities using Web 2.0 technology and the Internet as customer base. Later on in this research several of these E-Commerce revenue models are discussed in detail to see what role they can play for generating revenues with a Personal Health Records service.</p>
Care Delivery Organizations	<p>Hospitals might be willing to pay for a Personal Health Record too, if the PHR will allow their specialists to improve their processes and it is a valuable addition to the services they offer.</p> <p>The problem that arises here though is that the PHR gets segmented per CDO which, considering the number of them, will result in complex arrangements. So if this option gets pursued, it would be best to look for an alliance of organizations and cooperate in expanding the number of CDOs that make use of this PHR.</p>
Health Insurance Organizations	<p>Health Insurance organizations pay the costs their customers make for using public healthcare, customers also expect that. Offering a Personal Health Record as part of the health insurance policy might be a nice addition to their service and can help in lowering the costs.</p> <p>Already health insurance organizations are experimenting with personalizing services for a different policy fee<sup>1</sup>. A Personal Health Record service can have a similar financial construction, either by letting the customers pay a small fee for it or by seeing the cost reduction as a real benefit.</p> <p>The same problem as mentioned at CDOs arises here, segmentation occurs, but deals can be cut with an alliance of big CDOs to cover most of the market.</p>
Government	<p>E-Health is a hot topic for governments (national and European) and there are plenty subsidiary possibilities to get government money for E-Health applications that the whole healthcare sector can benefit from.</p>
Research	<p>Medical data is worth a lot of money for big pharmaceuticals and other research institutes. This does bring in a lot of complexities regarding dealing with trust and privacy of the customers, as obviously they would have to agree that their personal information gets used for such purposes.</p>

Table 4.9: Financial possibilities per actor

<sup>1</sup> E.g. Agis with takecarenow.nl especially for the young internet generation or the controversial fee reduction for organ donors.

# 5. What relevant business models are available in literature and how can they be useful for Personal Health Record services?

## 5.1 What is a business model?

Both in the academic as the business world, business models are still rather ambiguous and poorly understood<sup>1</sup>. It is still quite preliminary what a business model exactly is and what a business model should contain exactly, but all literature agrees on one thing: in short a business model answers the ‘how are we going to make money?’-question.

One of the pioneering researchers in business modeling is Osterwalder. He conducted a research into the spectrum of business models in 2004 in order to form an all encompassing business model, a so called meta-model. He kept specializing in that area and updating this model up till today. Osterwalder defines a business model as:

*“A business model is a conceptual tool that contains a set of elements and their relationships and allows expressing the business logic of a specific firm. It is a description of the value a company offers to one or several segments of customers and of the architecture of the firm and its network of partners for creating, marketing, and delivering this value and relationship capital, to generate profitable and sustainable revenue streams.” (Osterwalder, 36)*

Although the term ‘business model’ first dropped in an academic paper in 1957, it is still a fairly young term as it only started to become prominent in the late 1990s, ‘coincidentally’ in line with the growth of IT and especially the Internet in business. Not so coincidentally if you look at how technology has changed all business activities and you can understand why the need for business modeling emerged. With fairly cheap IT technology becoming gradually more mainstream, companies got opportunities to cooperate more and thus create complex value networks<sup>11</sup> plus also reach customers all over the globe (known as globalization and E-Business). These trends caused existing companies to reform their business and new ones to make really specific plans on what to offer and to who and how!

So how do you ‘express the business logic’? In order to understand which elements a business model needs to contain one has to understand its place in the firm. First of all, a business model is *not* a list of processes that have to be done, which is business *process* modeling, not business modeling. This confusion occurs a lot as the modeling part easily gets interpreted as process flow charts and organizational structures. The main focus of a business model is on value creation and customers. The business model serves its purpose on a different level, it is the underlying part in between a vision and a corresponding strategy, an operational plan in the form of an organization of tasks and processes (which is what the aforementioned business process modeling focuses on) and the technology (usually mostly IT). Hence people also sometimes like to refer to it as a business blueprint.

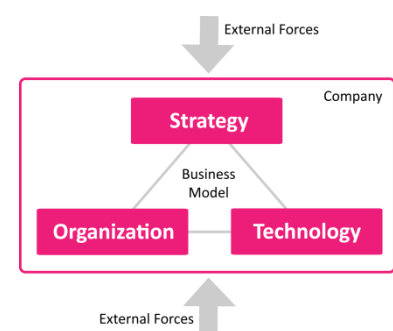


Figure 5.1: Place of the business model

<sup>1</sup> Linder, Cantrell (2000) “Changing Business Models: surveying the landscape”

<sup>11</sup> An example is the introduction of Apple iTunes that not only created revenues from the sales of online music, but also had the purpose to boost the sales of the iPod product line.

## Levels of business modeling

One can look at a business model on three levels:

Levels	Description
Meta-level	This level focuses on defining a business model. You pose questions like: What is a business model? What belongs in them? What meta-models conceptualize them? The content is very generic, such as building stones. Osterwalder his model is on this level.
Taxonomy	At this level, one takes a generic meta-model and analyzes or models common characteristics. This level is commonly used for conceptualizing a business model for a certain industry. (these models are also called sub-meta-models)
Instance	The most concrete level, where the business model reflects a certain company. This level works well for an analysis or modeling of business for a specific company.

Table 5.1: Three levels of business modeling

## Domains

Osterwalder researched a great number of known business models<sup>1</sup> and created a 9 building blocks meta-model based on the elements discussed in each paper he examined. The nine building blocks are categorized in four perspectives. In his original 2004 research he speaks of product, customer interface, infrastructure and financial aspects.

Later in 2008, in a graphical representation of his business model, he renamed those to offer, customer, infrastructure and finance. Given that this research focuses on the offering of a service, the term 'offer' would fit better than 'product' as it is more generic and suits a service, so his new terms are adapted into the table underneath:

Perspectives	Building block	Description
Offer	Value Proposition	Gives an overall view of a company its bundle of products and services.
Customer	Target customers	Describes the segments of customers a company wants to offer value to.
	Distribution channel	Describes the various means of the company to get into touch with its customers.
	Relationship	Explains the kind of links a company establishes between itself and different customer segments.
Infrastructure	Value configuration	Describes the arrangement of activities and resources
	Core capabilities	Outlines the competencies necessary to execute the company its business model.
	Partner network	Portrays the network of cooperative agreements with other companies necessary to efficiently offer and commercialize value.
Finances	Cost structure	Sums up the monetary consequences of the means employed in the business model.
	Revenue model	Describes the way a company makes money through a variety of revenue flows.

Table 5.2: Osterwalder his building blocks

<sup>1</sup> For a list of all used business models, see table 4 in Osterwalder his article

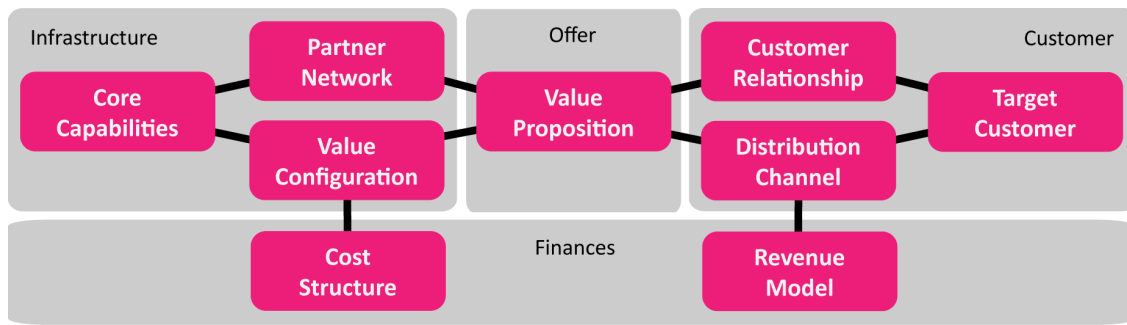


Figure 5.2: Osterwalder's business model

### Implementation

Osterwalder describes the implementation of a business model in three phases. The first phase is the design phase where a business model gets defined and designed that responds to market circumstances. The second phase entails sorting out the financial structure that fits the business model. The third and final phase is the actual implementation of the business model into the business organization.

### Use and potential

Using a business model has several benefits:

Benefits	Description
Understanding	First of all, a business model can be used to understand the relevant business elements and related success factors that are necessary for value creation. The business model gives a holistic view on the whole business and allows you to analyze and supply rather complex and thorough information.
Sharing	Due to its completeness and holistic view, the model can be used to communicate the success factors throughout the entire company or even third parties.
Comparing	Having a business model allows you to compare yours with what competitors use or business models from the academic world to assess the efficiency of yours and could lead to business model innovation.
Designing	The business model allows you to design your business, that is a rather complex process so a business model is an excellent tool to give structure to the design process and a guideline of what elements to address.
Implementing	When all changes are known, thought through, and communicable the implementation of going from A to B goes much easier than when the future is still a blur.
Prospecting	One can use the business model as conceptual tool to plot future business.

Table 5.3: Benefits of using business modeling

### Relevance for the Personal Health Records Business Model

This research aimed to create a so-called taxonomy for any E-Health organization to have a business model for putting a PHR in the Dutch market. Next to that, this research functioned as blueprint for a more specific report in which one could speak of an instance as well.

The main reason why the Osterwalder model got used is because he generalized his business model on a lot of other business models available in business science. Because of this general nature the model is an excellent business model to start with, knowing you will address all relevant aspects of value creation.

A slight note, when you look at the Osterwalder model you notice he does not take competition into account. Even though competition is a part of business, he claims it is not an *internal* part of business. You cannot directly control it, thus not model it.

Also the factor time is important here, a business model should be dynamic and you have to change it when environmental changes occur. Linder and Cantrell go deeper into change models but this is out of the scope of this research, as first a business model needs to be initiated.

To twist this meta-model into an industry specific model (taxonomy), this research explores which (industry-specific) business logic and critical design issues can be put under each of the nine building blocks.

## 5.2 Blue Ocean Strategy

Chan Kim and Mauborgne wrote an article about what they call the Blue Ocean Strategy. They claim the market universe is either a red ocean or a blue ocean. Red oceans are all industries in existence today typified by known boundaries and settled rules regarding competition. The main drive of companies here is to win market share from their competitors by product innovation or process innovation to outperform others. The competition is deadly; hence the ocean is red of all the blood. Blue oceans are different, here competition is irrelevant as the market is so new and unsettled and there are no clear market boundaries (yet). In fact, it shall be the market of the future but that makes it all quite unknown territory. Instead of stealing market share from your competitors here it is a bigger challenge to initiate a certain demand and keep it, in other words come up with a product or service that people want to use. The ocean is blue as it is wide and deep offering plenty of options.

The Medicine 2.0 market, especially in The Netherlands, can also be seen as a blue ocean. Businesses are experimenting with several solutions and there is no settled product (in innovation management referred to as niche markets). These experiments by competitors are excellent to take into account to assess your own options, however but no competition-driven strategy needs to be pursued. The strategy should focus on grasping the exact market needs so you can eventually become the 'biggest fish in the ocean'.

## 5.3 Searching for other business models and relevant business logic

Next to looking at the actors to get ideas what everyone wants and additional business logic for the PHR business model, we can also look into other literature to find existing business models that have similarities with a PHR service. If we look once more at the definition that Eysenbach formed of Medicine 2.0, we can spot several keywords that are good to use as input for snowball sampling for business models and related business logic. These keywords are highlighted in the definition:

*"Medicine 2.0 applications, services and tools are Web-based **services** for **health care** consumers, caregivers, patients, health professionals, and biomedical researchers, that use **Web 2.0 technologies** as well as ~~semantic web and virtual reality tools~~, to enable and facilitate specifically **social networking**, participation, apomediation, collaboration, and **openness** within and between these user groups." (14)*

Combining that with the definition for a business model:

*"A business model is a conceptual tool that contains a set of elements and their relationships and allows expressing the business logic of a specific firm. It is a description of **the value a company offers** to one or several segments of customers and of **the architecture** of the firm and its network of partners for creating, marketing, and delivering this value and relationship capital, **to generate profitable and sustainable revenue streams.**" (Osterwalder, 36)*

Based on searching on these keywords, the following literature was selected to lay the basis for the PHR business model:



## Service

Author	Paper	Description
Stabell & Fjeldstad	Configuring Value for Competitive Advantage: On Chains, Shops, and Networks	Describes the <b>value configuration</b> of three types of businesses. One of which is a value network that fits a <b>service-oriented</b> organization.
Bouwman	Mobile Service Innovation and Business Models	Describes the STOF business model, a <b>business model</b> especially designed for offering <b>services</b> .

## (E)-Healthcare

Author	Paper	Description
Parente	Beyond The Hype: A Taxonomy Of E-Health Business Models	Parente describes several <b>business models</b> from (successful) <b>eHealth</b> businesses in 2000 and could be seen as pioneering research in the subject of this paper.

## Web 2.0

Author	Paper	Description
HowStuffWorks + SIIA	Application Service Provider + Software-as-a-Service (SaaS)	A business philosophy that software should be offered as a <b>service</b> , which underlines and has implications for the <b>organization</b> to become an <b>E-Business</b> .
Timmers	Business Models for Electronic Markets	Key paper when it comes to describing taxonomies of <b>E-Business models</b> .
Zott & Amit	eValue framework	The eValue framework describes four value drivers specifically for <b>value creation</b> in <b>E-Business</b>
Kangas et al	"Ads by Google" – Social media	This article examined which business or rather <b>revenue models</b> appear in <b>E-Business</b>

Table 5.4: List of literature

### 5.4 Service business model: Stabell & Fjeldstad's Value Network

Osterwalder said that a business model describes the value creation (14), so it would be logical to look at the value creation as a first step. In the paper "Configuring Value for Competitive Advantage: On Chains, Shops, and Networks" (45), Stabell and Fjeldstad describe three forms of value configurations: value chains, value shops and value networks. This article by Stabell and Fjeldstad gets used a lot in the academic world of Business Administration, as it is one of the key articles regarding value creation and an extension onto Porter's value chain framework. For a Personal Health Records service the concept of a value network fits the service best:

*"(..)the value network models firms that create value by facilitating a network relationship between their customers using a mediating technology. Hospitals, professional service firms, and educational institutions are examples of firms that rely on an intensive technology." (45)*

#### Value creation logic for a value network

Societies are characterized by a complex set of actual and potential relationships between people and organizations. Linking, and thus value creation, in value networks is the organization and facilitation of exchange between customers. The linking can be direct (e.g. a phone service) or indirect (e.g. a fund pool at a bank). Mediators act as 'club managers', the organization admits people and organizations to their 'club' that complement each other and the organization establishes, manages and terminates direct and indirect relationships between the 'members'. A set of customer contracts commit both the customer and the company operating the network to a mutual set of obligations.

This 'club manager' idea also works for a PHR, the PHR service (and thus the organization offering this service) facilitates patients, healthcare professionals and all PHR actors to exchange information. Also, the PHR service links these actors, be it direct (people granted to look into each other's PHRs) as indirect (offering a platform for peers). The role of the mediator is a tad different than how it is described by Stabell and Fjeltstad, as a PHR is an *apomediator*, so instead that the company does the mediating, the tool takes care of the mediation, the task of the company should be making sure this tool *apomediates* optimally.

Service value comes from positive network demand side externalities, a network gets more valuable when it has more members. A new service has a relatively low value for its first customers, whereas the costs usually are the highest in the introduction phase. Value (from the perspective of the customer) is derived from the service, the service capacity and the service opportunity. Obviously the better the service, the higher the perceived value is of the customer. The service capacity is important when the number of patients becomes large enough to serve the intensity of information needs; the service enters a 'steady state'. A customer might receive value from the value network without actually invoking mediation services, e.g. making an account and even willing to pay for it but hardly or not use it, this is known as service opportunity.

Standardization facilitates matching compatible customers and to effectively maintain and monitoring the interaction between them.

A Personal Health Record gets more valuable the more patients and health professionals use it (like with Metcalfe's law). Next to that the more collective wisdom is present, the more valuable the shared information becomes (service capability). Standardization can be pursued by using Internet standards (and the Internet per se) and so-called syndication<sup>1</sup>.

Customers may be willing to pay a premium price for a new service. However, as the value of the service is dependent on who else adopts it, it may be difficult to target these customers on an individual basis. Stated differently, the value of the service is managed by the rollout process for the service. Following a successful rollout, mediators may be in a position to charge for membership, service, and equipment in a potentially long-term operations phase in which contracts, infrastructure, and service activities are performed concurrently.

The rollout of a personal health record in Holland is an important point of attention especially with the current scepticism caused by the EPD and the general scepticism regarding privacy and health information. This scepticism not only makes it tougher to get patients (even doctors too) to adopt to the PHR, it will also put oil on the fire regarding the unwillingness of patients to pay for new E-health services as a response to the poor or failed perceived value that earlier E-health services offered.

In summary, the business value system in a mediation industry is potentially a set of coproducing, layered and interconnected networks that enhance the range and reach of the services provided.

## Representation of value creation

As there is mediation present, it distinguishes different mediators. There are however strong similarities between the activities of various value networks even if the terms used to describe them differ from industry to industry. For a mediator there are primary and support activities.

The primary activities of the value network are as follows:

- *Network promotion and contract management* consists of activities associated with inviting potential customers to join the network, selection of customers that are allowed to join and the initialization, management, and termination of contracts governing service provisioning and charging.

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<sup>1</sup> Web syndication is a form of syndication in which website material is made available to multiple other sites.

- *Service provisioning* consists of activities associated with establishing, maintaining, and terminating links between customers and billing for value received. The links can be synchronous as in telephone service or asynchronous as in electronic mail service or banking. Billing requires measuring customers' use of network capacity both in volume and time.
- *Network infrastructure* operation consists of activities associated with maintaining and running a physical and information infrastructure. The activities keep the network in an alert status, ready to service customer requests.

Translating these primary activities to a Personal Health Records service, the network promotion hooks into the aforementioned scopsis and network externalities. The network promotion will make or break the success of the service as it needs to make as much people possible willing to use the service. The service provisioning and network infrastructure are important for the core capabilities (keeping the application running acceptable) and technical aspects of the infrastructure.

Among the support activities of the value network, two distinct, but related technology development activities are of special interest:

- *Network infrastructure development* includes activities associated with the design, development, and implementation of network infrastructure.
- *Service development* includes everything from the modification of a large set of possible customer contract terms to the development of brand new services. It also includes modifications to the company-customer interface through modifications of procedures, forms and self-service computer interfaces.

These two points are important for service innovation and the development of a service. Demands and technology are always changing and therefore a Personal Health Record can never be in a static state. Instead, the technology and the service need to be constantly updated and allow e.g. new interconnectivities or different sources of information. The service business model by Bouwman (7) in the next chapter goes deeper into service innovation.

### Diagnosis competitive advantage

Competitive advantage is assessed with the drivers of cost and value. As mediating firms offer value to their customers both through the access option and the actual use of services, cost and value must be associated with both. In the table underneath these drivers are summed up and put into a Personal Health Records perspective:

Driver	Description
Scale and composition	<p>Scale is a potential driver of both cost and value in the value network. Value network services are characterized by demand-side economies of scale resulting from positive network externalities. In value networks, the other customers are the key part of the product. The services of a value network mainly deliver the customers opportunities to exercise those dependencies.</p> <p>Size and composition of the customer base are therefore the critical driver of value in the value network. When network externalities are present, the value of the service provided is affected by the characteristics of customers that join the network, e.g. patients with a similar illness or family members.</p> <p>Scale is also important to the extent that it affects accessibility, however a less interesting subject for PHRs as Internet already offers a high accessibility as it renders geographic reach unimportant.</p> <p>The evolution and diffusion of standards are therefore critical in the exploitation of demand side scale economies, therefore it is important to use standards to read out secondary sources of information (syndication) and combining them in the PHR.</p>

Capacity utilization	Capacity utilization is closely related to scale, the higher the utilization, the lower the unit costs. High capacity utilization, however, may also reduce service levels, when e.g. the load gets so big that it harms the service and causes customer dissatisfaction, e.g. a dreadfully slow or inaccessible website.
Linkages	In the value network there is reciprocal interdependence across primary activity categories due to the need for synchronization and dimensioning of simultaneous activities. Important linkages arise from this reciprocity, for instance, patients who just heard they have a certain illness like to be linked to patients who already went through the early stage in order to hear useful information.
Learning	The key areas for learning in primary activities are in membership selection and service monitoring, especially that latter. To innovate the Personal Health Record service, it is important to keep an eye on what patients want and how they use the service.
Strategic positioning options - Vertical scope	A mediation exchange requires multiple levels of coproducing mediation activities. The activities of one mediator build on the activities of another. Vertical scope in mediation industries describes to what extent a firm controls all levels of coproducing activities required to complete mediation exchanges. Choice of scope depends on whether suitable lower-level mediation services covering the relevant customers are available.
Strategic positioning options - Horizontal scope	A firm that delivers a mediation service can extend its customer segment scope either by increasing its own customer base or by exchange agreements with other mediating firms that extend the set of exchanges that the firms provide for their customers.  In other words in case of a Personal Health Record, cooperating with other parties might help in increasing the customer base. E.g. cooperating with a health insurance company gives the company an opportunity to expand the customer base with the customer base of this health insurance company. This also applies for the customer base of a hospital or even health care professional.

Table 5.5: Drivers competitive advantage

## 5.5 Service business model: Bouwman's STOF Model

A recent business model for (mobile) service innovation is the STOF model by Bouwman (7) and has a lot of parallels with (online) healthcare services. His book deals with describing what services are, what service innovation is and it introduces a model that focuses on balancing four domains (STOF, see figure) - which correspond with the perspectives from the Osterwalder business model. Under these domains Bouwman introduces certain service (innovation) specific critical design issues, which are points to be taken into account when shaping your business model.

Idenburg addresses a number of specific consumer trends: individualization, self chosen collectivism, informalization, cultural diversity, intensivation, and feminization that affect the need for new service concepts, for instance self-service or community based servicing. At the same time technical developments offer opportunities for service innovation. These trends also reappear in the philosophy of Medicine 2.0 and the practices of Personal Health Records especially the individualization (it puts the P in PHR) and self chosen collectivism (assigning the rights which information to share with whom) really pop up in a PHR.

Bouwman (7) also points out that the existence of so many different business models illustrates the lack of a common framework. Bouwman focuses on customer value and on the organizational, technical and financial arrangements needed to provide a service that offers value to customers and allows the providers of the services to capture value as well. In his view business models have to focus on four domains: service, technology, organization and finance, and within these domains different components play a role.

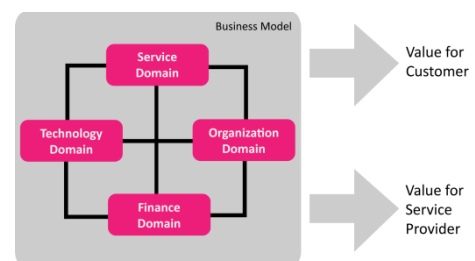


Figure 5.3: STOF model

The classification and components of the STOF model is a lot abstracter than the business model by Osterwalder. Take for instance the 'service domain', in essence it deals with the value proposition, the customer segmentation and CRM all at once. Therefore for clarity this research prefers the Osterwalder business model.

However what makes the STOF model valuable for this research is the fact that Bouwman seeks for Critical Design Issues and subsequent Critical Success Factors to put under the components, to balance the (often varying) goals between the actors inside the business model. A CDI is defined as a design variable that is perceived to be (by practitioner and/or researcher) of eminent importance to the viability and sustainability of the business model. By describing the CDIs, one can describe the crucial pinpoints of a business model, which is what this research wants to achieve for the Personal Health Records Business Model as well.

These CDIs that Bouwman (7) introduce at a service business model are:

Component	CDIs
Service	Targeting
	Creating Value Elements
	Branding
	Customer Retention
Technology	Security
	Quality of Service
	System Integration
	Accessibility for Customers
	Management of User Profiles
Organization	Partner Selection
	Network Openness
	Network Governance
	Network Complexity
Finance	Pricing
	Division of Risks and Investments
	Valuation of Contributions and Benefits
	Division of Costs and Revenues

Table 5.6: STOF model components

In chapter 6 these CDIs reappear (implicit) in Osterwalder his business model and elaborated from a Personal Health Records perspective as these CDIs return in-depth in the other business models and business logic that get discussed.

## 5.6 E-Health business model: Parente's impact of eHealth

Parente (37) his research is pretty preliminary as it predates most of the research put into Medicine 2.0 and Health 2.0. Next to that with the quick developments of Web 2.0 his work is a bit outdated but it is actually one of the few articles that *do* exist about E-health in combination with business modeling and shows that 'regular' E-Commerce business models *are* successfully being used in a healthcare environment and thus applicable for healthcare, making E-Commerce models relevant for this research.

This paper introduces E-Commerce, its application to health care and the reasons why the health policy community should monitor its development. Parente found the existence of four forms of E-Commerce practiced in the healthcare area. Of these four forms Health E-Commerce Portal and Health E-Commerce Connectivity are two forms that are directly relevant to Personal Health Records, the other two; Health E-Commerce Business-2-Business and Business-2-Customer are not of any interest as they involve commercial activities with physical goods.

## Health E-Commerce Portal

The portal is the most common face of the Internet to the consumer, providing a launch point for various online activities. Examples of big portals are e.g. msn.com (all sorts of online activities), nu.nl or slashdot.org (both cumulate news). All portals try to become the first source a customer checks out when searching the Internet. Branding is very important for portals, if people remember the name of your portal it means they can come back. Portals derive revenue mainly through advertising, though some work with subscription fees (e.g. AOL.com).

Health E-Commerce portals are the face of the medical Internet to both customers and providers seeking medical guidance and information on new medical innovations. Microsoft already shows how a portal can be used in the healthcare area with their HealthVault services. They offer a whole package of health related activities with the main focus on searching health information and tracking medical data, Lifesensor is also a good example herein as it offers more services such as making appointments digitally. This diversity of activities will cause people to return to the portal more frequently.

## Health E-Commerce Connectivity

Another development of E-Commerce is businesses that link information systems seamlessly. A good example here is cheaptickets.nl where people can compare prices of several (budget) airlines. Health E-Commerce connectivity initiatives include Internet accessible EMRs, assessment of provider quality based on clinical outcomes and use of quality data in physician selection. A PHR also connects several sources of information (systems) seamlessly; in fact that is one of the strong points of a Personal Health Record. However a PHR should not be seen as a hub. It combines several information systems and presents the information in an information system aimed towards the patient.

## 5.7 Application Service Provider

Application Service Provider (ASP) is a business philosophy or business concept that emerged from Web 2.0 (33) and E-Commerce. Companies that take care of certain services is not a new phenomenon obviously but the shift to of these services to the Internet is rather new, as it started in the early 2000s. Instead of selling a piece of software to customers an Application Service Provider offers the *use* of their software as an online service and let them pay for this service and not the software as is. Usually the charging fees are based on the frequency or intense of use. Some people also like to refer to this as Software-as-a-Service, however this term appears to target more on Business-to-Business constructions.

Characteristics of ASPs are:

- The ASP owns and operates a software application, in this case the PHR.
- The ASP owns, operates and maintains the servers that run the application. The ASP also employs the people needed to maintain the application.
- The ASP makes the application available to customers everywhere via the Internet either in a browser or through some sort of "thin client."
- The ASP bills for the application either on a per-use basis or on a monthly/annual fee basis. In many cases, however, the ASP can provide the service for free or will even pay the customer.

For instance a Gmail<sup>1</sup> account can be seen as a ASP solution. You subscribe to the whole package (having an email address, online file space to store email and data, availability of the mailbox anytime anyplace, etc) and Google benefits from that with ads, customer connectivity and branding\networking (so that their customers use other Google products too).

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<sup>1</sup> <http://www.gmail.com>

The same ASP-philosophy can also be applied onto Personal Health Records. First of all, it explains why a PHR should not be seen as a piece of software but as a complete service. This service acts in two ways, from the patient point of view and the health professional point of view: A patient experiences the service of keeping track of his health information using a tool offered by the PHR service provider. The tool itself is not important to the patient per se, the whole service is. Considering the current market in Holland the ability alone to keep track of a widely supported Personal Health Record can be seen as a service demand, which is at least of equal importance as the (technical) tool itself.

The health professional can also use this PHR application to improve his service by using it as a tool to communicate information to the patient plus the opportunities that PHRs can offer regarding e.g. pre-visit inquiries to optimize the processes. Again, here the value of the tool lies in the benefits it creates for the daily routines of health professionals.

The provider of the PHR can benefit from offering the service, so the provider does not sell the PHR itself but the opportunity to start and maintain a PHR, its *usage*. Revenues should be based on this usage. There is also a benefit in becoming the leading PHR service in Holland for continuity and market importance, e.g. other commercial parties might want to interconnectivity with the PHR and want to pay for that.

*"(...), one of the defining characteristics of internet era software is that it is delivered as a service, not as a product. This fact leads to a number of fundamental changes in the business model of such a company." (33)*

One of the biggest fundamental changes would be the overall understanding of the presence of the S in ASP. Many (traditional) IT companies still think in a "we make an application, sell it and be done with it" and totally forget the significance of providing service.

Another change is the way the organization is organized; it takes a different set-up to be responsive and successful in the rapid Internet world. O'Reilly likes to call this a *lightweight business model (34)*, which he claims are a natural concomitant of lightweight programming and lightweight connections. A lightweight business model can be typified with two points:

- Operations must be a core competence;
- Users must be treated as co-developers.

In case of a PHR what operations are there? First of all, the connectivity and integration of information is an important task for the vendor. In order to guarantee continuing information quality and new connections that users would fancy, e.g. from new EHR initiatives. Sitting still is giving the opportunity for others, especially in a highly innovative world as Web 2.0 where the usage of standards not only means easier connectivity, it also means others can easily combine the same information in a new fashion (so called mash-ups) and pinch your revenues or even worse, make your product redundant.

Another important operation is service maintenance as for instance a few minutes downtime is already lethal for the reputation of an online service.

Health professionals and patients have different needs regarding medical information. Listening to these needs and involving these users into pilots of the new technology will make sure that the service will suffice to these needs. Another way to see customers as co-developers is by understanding that they feed the service with information and therefore they make the service get its value.

Next to that, the word 'lightweight' should be taken quite literally. The whole value creation should be as lean and mean as possible. So that means lightweight production teams (optimal in size, flat in hierarchy), no-nonsense marketing, easy solutions (provide simplicity to the users and also use simple, commonly used technology(syndication)) and the value creation should light enough to be very dynamic as the Web 2.0 world can change in the blink of an eye.

## 5.8 E-Business model: Timmers' Business Models for Electronic Markets

E-Commerce can be defined loosely as "doing business electronically" (European Commission, 1997). This new opportunity of commerce also requires a different way of doing business, in literature referred to as E-Business. Timmers' paper is seen as one of the key papers regarding business models and E-Business\ E-Commerce. Even though the paper is already a decade old, it is still valid and gets references in more modern literature that specifies these models more specifically. Timmers (48) found eleven different business models (E-shop, E-procurement, E-auction, E-mall, 3<sup>rd</sup> party marketplace, virtual communities, value chain service provider, value chain integrator, collaboration platforms, information brokers, trust services) of which a few are interesting business models for Personal Health Records either individually or mixed.

Business Model	Description
Virtual Communities	The ultimate value of virtual communities is coming from the members (patients) who add their information onto a basic environment provided by the virtual community company. The membership fees and/or advertising generate revenues for the hosting company.
Collaboration platforms	These businesses provide a set of tools and an information environment for collaboration between multiple enterprises. This platform can focus on specific functions, such as collaborative design and engineering or in providing project support with a virtual team of consultants. Business opportunities lay in managing the platform (membership/usage fees) and in selling the specialist tools.
Information brokers	Brokers add value to the big amounts of data available on the open networks or coming from integrated business operations, such as information search, e.g. Google, customer profiling, business opportunities brokerage, investment advices, etc. Usually information and consultancy have to be directly paid for, either through subscription or on a pay-per-use basis although advertising schemes are also conceivable.
Trust services	A special category of information brokerage is trust services provided by certification authorities and electronic notaries and other trusted third parties.

Table 5.7: E-Business models according to Timmers

A Personal Health Record can feature one of a combination of all of the four above mentioned business model concepts. According to Timmers all four models can be classified as highly innovative as they create new opportunities and *change* traditional functions drastically instead of just simply *transposing* traditional sales functions to the Internet (which e.g. an E-Shop does). New innovative opportunities that a PHR could deliver is faster sharing of information and empowering the patient over his own health information processes which answer to a certain trend in the healthcare market.

The first two, virtual communities and collaboration platform, require high integration of functions according to Timmers. In the context of a PHR that would mean a high level of interconnectivity. The spreading of information and the collaboration to spread it is vital for the success of a PHR. A Personal Health Record can be best seen as a virtual community as patients can decide how to share their health information and hence create a community around their health record by e.g. sharing information with health professionals, but also family members, friends or co-workers should be possible. When a patient and health professional use the PHR for treatments, we can also speak of a collaborative effort with the PHR as platform.



The key content of a PHR is information. Information brokerage is a result of the already mentioned interconnectivity that users of a PHR will combine and share information. This sharing also goes a bit further than just brokering, patients shall also assess the content and that way according to *crowd wisdom* filter the content according to their standards and in case of a PHR2.0 also according to standards of others. Ideally good information shall be shared and bad information shall be filtered out, again, a collaborative effort on the PHR platform.

The last business model from Timmers' article is trust services. The concept of trust services is also valid for Personal Health Records. Many articles discuss that health information is very special information as most people consider it quite confidential and private<sup>1</sup>, however the youth is changing and share even confidential information easier. Still, trust is important for these people and they do not want information to fall in the wrong hands. The organization that offers the PHR should work on creating and protecting this trust obviously some image like a long history in the healthcare market surely helps.

## 5.9 E-Business model: eValue framework

Amit and Zott came up with the eValue framework (3) which describes value creation logic specifically targeted for E-Business and this is a good addition on the value creation logic described by Stabell & Fjeltstad. According to Amit and Zott eValue has four main value drivers:

Driver	Role for a PHR
Efficiency	<p>A business model based on enhancing inefficiencies in transactions by enabling reduced search costs\time, transaction speed, reduced distribution costs, reduced inventory costs and more.</p> <p>The PHR service can create much more efficiency in the data transfers in between patient and health professional and vice versa. Next to that a PHR can also fix the information asymmetry (e.g. missing/delayed information or redundant diagnosis) between health professionals if the information gets shared via the patient as an additional or replacing information source next to existing EHRs.</p> <p>This efficiency aspect is one of the key benefits of using PHRS so pinpointing all the actors on these efficiency gains is vital to gain interest.</p>
Complementarities	<p>Complementarities entail the combining and bundling of services (usually from 3<sup>rd</sup> parties) to improve the overall customer experience of the core service. The business model focuses on value creation by capturing the benefits from combining online with offline businesses, complementarities among technologies and complementarities among the activities of participants in the business model.</p> <p>To make a standalone PHR more appealing, there are other additional services that can be added that will make the core service more attractive. A good example of this is what Microsoft HealthVault offers, the ability to search information of certain illnesses. Another example is what ICW Lifesensor offers, a complete healthcare service portal with an appointment manager, etc.</p> <p>A current healthcare trend is that patients not only want to be busy with their health when they are ill but also when they are doing well. In the last decennia more and more money gets spent on so-called well-being and cosmetic products (as well as cosmetic services), so there is also a growing interest in complimentary products and interesting information about these.</p>

<sup>1</sup> One can refer to it again and again, but the national scepticism towards the EPD is a good example that a lot of people do not fancy it when their health information is available on the Internet.

Lock-in	<p>Lock-in is all about engaging users in repeat actions. Lock-in can be enabled, for example, by creating switching costs that customers would face if they were to switch to a different service provider. Switching costs are created through loyalty programs, by providing transaction safety and creating the perception of trust, through familiarity with the site, the inconvenience of change and also through customization and personalization.</p> <p>For PHRs trust is a very important factor to arrange lock-in. Once the PHR service provider manages to gain the trust of patients. It can be a competitive advantage to have a good image compared to other companies with lesser credentials.</p> <p>Personalization obviously is a strong point of a PHR too; after all, that is what the P stands for. Patients can continuously personalize their health data by adding new personal information.</p> <p>Lock-in is also important for usage-dependent revenue models, as the money needs to come from repeated action over a period of time.</p>
Novelty	<p>The final driver Amit and Zott discuss is novelty. Introducing totally new, innovative products, business models or basically anything lucrative for business can be the 'next big thing'.</p> <p>In Holland there is still no dominant PHR service, in fact, even worldwide all PHR-initiatives are still at their infancy and therefore there are a lot of opportunities to come up with a new, innovative product.</p>

Table 5.8: eValue drivers

All of the four drivers are valid for a PHR depending on what the vendor wants to focus on. The efficiency value is something that should be communicated to the users. It would be an important marketing topic to explain why they should use a PHR and what it is good for. Complementarities offer revenue possibilities by placing advertisements or integrating other companies their products and services into the service. Lock-in is important as well, a PHR should be maintained on a recurring basis by the users and it is especially important when a pay-per-click revenue-model gets implemented. If the revenues of the service are connected to the usage, patients should come back at least a few times. Considering the novelty of a PHR service, there are still a lot of business (model) opportunities.

## 5.10 E-Business model: "Ads by Google" – Social Media

This paper by Kargas et al deals with several business models for so called Social Media:

*"Social media is built of content, communities and Web 2.0 technologies. Social media refers to applications that are either completely based on user generated content or in which user generated content and the actions of users play a substantial role in increasing the value of the application or service." (25)*

A PHR has the same characteristics as the definition of Social Media. The paper by Kangas et al (25) focuses on the choice of revenue generation as a taxonomy of the business models they found, in fact, they solely discuss the revenue generation thus maybe it is better to speak of revenue models or E-Revenues than complete business models.

As for the currently actively used business/revenue models there are:

- No business model and risk financing
- Advertisement (self or mediated)
- Subscription (partially or totally)
- Affiliate (aka merchandise)

## No business model

Obviously the option 'no business model' makes no sense in this research as we try to formulate one, however the fact remains that the majority of Internet firms have no clear business model. Big players such as Wikipedia or Facebook are examples of businesses without a business model. Ironically both businesses got into financial problems at the end of 2008 and are currently exploring possibilities to avoid such problems in the future.

A lot of these businesses start small with the hope to grow big and then sell-out to an even bigger player, usually Google, for a big bag of cash. The investments put in such high hope companies are known as risk financing. Their business model is like 1) have a great idea, 2) get funding and release it free to get the biggest market possible, 3) if it proves popular, raise more money to scale up and 4) repeat steps 2 to 4 until a big(ger) company buys your company.

## Advertisement

Advertisement is the most popular form of revenue generation on the World Wide Web. The concept is a lot like the traditional business model of free media and fairly simple. This simplicity is why some business gurus claim that advertisement is often not really a business model either as companies just whack some advertisements on their website and think that is enough to fund the operations around providing free content publically and all other costs.

According to Rappa (38) advertisement can be done in several ways:

Type	Description
Portal	The website is usually an interface for searching information from other sources. It focuses on getting a lot of users that use the website for a brief while to move on to other content or services and whilst they use the portal they see some placed advertisement. E.g. Google.com.
Classifieds	This is a list of items that are for sale. Usually the 'placer' pays a listing fee or has some long term contract. E.g. the heart monitoring devices on HealthVault.
User Registration	The website is free but requires a user registration which allows the generation of potential information (e.g. tracking) for advertisement campaigns or information brokerage.
Query-based Paid Placement	This is where the advertisement is based on popular keywords or sponsored links. E.g. the advertisements on Google.com after a search.
Contextual Advertising / Behavioral Marketing	Here a free website is bundling adware, e.g. pop ups from different websites when using a certain service. E.g. illegal piracy websites.
Content-targeted Ads	This involves ads that are generated based on the content of the website. E.g. Google AdSense that third parties can implement on their website.
Intracommercials	Animated full-screen ads placed at the entry of a site before a user reaches the intended content.
Ultracommercials	An interactive online ad that requires the user to respond intermittently in order to wade through the message before reaching the intended content.

Table 5.9: Advertisement possibilities

## Subscription

Only about 10% of the (E-)businesses use subscription-based revenues. The reason that the number is low is probably because subscription has the dilemma how to pull users in. The value of the service is still dependant on the numbers of users (as *they* create the content –the crux of social media) therefore getting the more users, the better but not everyone likes to subscribe!

In practice, multiple sources claim that the **best** implementation of online advertising can generate about 2 cents per view of revenue.

Rappa (38) describes three common forms of subscription:

Type	Description
Content Services	Provide text, audio, or video content to users who subscribe for a fee to gain access to the service. E.g. Lifesensor
Person-to-person Networking Services	Conduits for the distribution of user-submitted information, such as individuals searching for treatments, reviews etc. E.g. nomoreclipboard.com
Trust Services	Membership associations that act according to an explicit code of conduct, and in which members pay a subscription fee. E.g. online banking

Table 5.10: Subscription possibilities

These forms more show where the motivation for subscription focuses on, so on subscribing to the content, subscribing to the data flows inside the network \ community or subscribing to trustworthiness, all three can apply on a Personal Health Record, again based on choices the vendor makes.

The word “free” is very important with social media and that does not mix well with the general concept of subscription. The most common way to solve this is by making the basic features free of charge and offer extra features for a periodic fee. This construction is excellent to generate revenues from loyal, heavy users who truly think they benefit from the service and thus are willing to pay for it. This business model of providing a free and premium variant of the service is often called “freemium”<sup>1</sup>. In practice this business model is not used much as it is difficult to say how much people are willing to pay for extra features. There are a lot of variables and also uncontrollable ones at stake. For instance a competitor can release a similar service *for free* in no time, rendering your business model useless. Next to that, half of the Social Media users<sup>2</sup> are so-called couch potatoes as they only passively consume the content of the service and do not care about premium features.

Some services are even completely fee-based though, this revenue model is often used in online gaming, such as World of Warcraft. A healthcare example is Lifesensor where you pay 60 dollar a year for keeping a Personal Health Record –with some additional features though. In this construction it is however less common that users want to create (all) content themselves; they expect value for their money.

## Affiliate

Affiliates involve a form of advertisement where there is interdependency between the vendor and the affiliate. Kangas calls the revenue model ‘merchandise’ which explains the situation quite well. The website of the vendor offers a link or picture towards an affiliated company’s website or product and for each click or sale, the vendor gets money. This differs to advertisement where there is no action required; just the presentation of an ad to the user is enough.

Type	Description
Banner Exchange	Trades banner placement among a network of affiliated sites, in this case, E-health websites or other healthcare market related websites.
Pay-per-click	Sites that pay affiliates for a user click-through, i.e. offer links to other E-health websites.
Revenue Sharing	A percent-of-sale commission based on a user click-through in which the user subsequently purchases a product.

Table 5.11: Affiliation possibilities

Banner exchanging can be interesting for a PHR to hook into existing virtual communities, such as e.g. the user base of a health insurance company. Pay-per-click can be interesting too, even though it is strongly dependent on the willingness of patients to click on the link and you do not want to distract them from using the PHR. In practice the revenue sharing part is probably the most interesting option as a PHR offers possibilities to integrate third party services and the ability to ask a little markup for the integration.

<sup>1</sup> <http://online.wsj.com/article/SB123335678420235003.html>

<sup>2</sup> Based on recent figures from Forrester: 42,8% of the people on the Internet actually creates content

A good example of revenue sharing is the [nomoreclipboard.com](http://nomoreclipboard.com) service; there is a win-win situation for both parties when a patient uses this service. The [nomoreclipboard.com](http://nomoreclipboard.com) company get a customer for their product (plus revenue) and the PHR service provider gets customer lock-in as the content (and thus value) of the service improved in the eyes of the customer.

### Community model

A special case of business model is the community model. It is special in the sense as there is no direct monetary benefit from this business model but indirectly it offers a lot of possibilities. The philosophy applied here is that having a community at your disposal can be seen as a valuable asset as well, in fact, it is worth money. In fact, you can sell the community. The idea here is that you do exactly what the community wants to create a loyal and as big as possible community.

The benefits lie elsewhere than in direct monetary revenues, e.g. the following possibilities:

- Attract a community that can be used to market research of other (third party) products;
- Attract a community and expand the community of an existing service;
- Create win-win situations, e.g. improve the services of third parties, such as hospitals or health insurance companies.

The latter one is a very interesting one in case of PHRs. Health insurance companies are the ones who pay for public healthcare and if a PHR can improve the efficiency of public healthcare, they might be willing to pay a sum of money to the vendor for creating such a community.

### Comparison

The strengths and weaknesses of each of these revenue models are summed up underneath:

	Ads (self)	Ads (3 <sup>rd</sup> party)	Subs (freemium)	Subs (totally)
Strengths	When usage gets high, revenues scale up with costs	When usage gets high, revenues scale up with costs	Usage independent revenues*	Usage independent revenues (even financial burden)
Weaknesses	Dependent on number of visits \ use (if low not profitable)  Advertisement administration costs	Dependent on number of visits \ use (if low not profitable)  3 <sup>rd</sup> party gets a fair cut in the revenues	Lots of people will use service for free, only a few subscribe*  *) a few users have to carry the financial burden of the whole	Causes a barrier for people to even try it  Different expectation of content generation

	Banner Exchange	Pay-per-click	Revenue Sharing	Community
Strengths	Networking with other big e-Health websites to lure people in	Non-intrusive advertisement	Usage independent revenues, not much effort	Social networking is an incentive for lock-in and improving the usage
Weaknesses	Dependent on the popularity of others and the willingness of their users to click  Might distract your own users with other possibilities	Dependent on the willingness of your users to click	Dependent on the reputation, quality etc of a 3 <sup>rd</sup> party product	Not really a revenue model, as it utilizes other revenue models to generate revenue

Table 5.12: Strengths and weaknesses of revenue models

Combinations of revenue models are possible. E.g. Youtube.com has advertisement on the website and is currently also investigating if they can offer additional premium content to people who are willing to subscribe to the YouTube service for such content. Possible premium content –and this is just an example- for PHRs would be allowing digital media (pictures, videos, audio, PDFs) etc into the PHR for an annual fee and keep the regular text-only part free of charge for everyone who is interested. Another option could be allowing users to create one free PHR and for a small fee multiple.

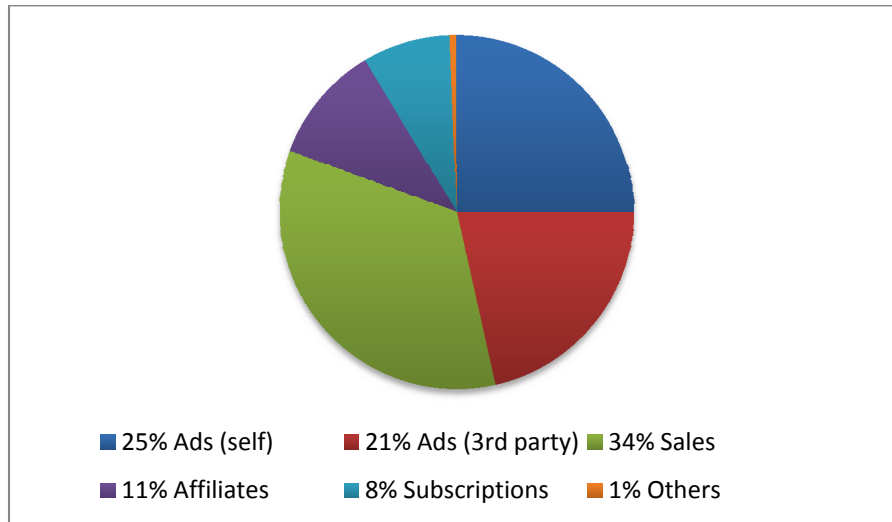


Figure 5.4: E-Revenues (source bizak.com)

The pie chart above shows the popularity of the business models in based on an inquiry conducted in 2006. When looking at current revenue models in E-Commerce, one can see that nearly half of all E-Commerce companies use a form of advertisement as source of revenues. Product sales comes second and additional affiliated services and subscriptions are respectively third and forth.

# 6. Personal Health Records Business model

## 6.1 PHR Business model

The purpose of this chapter is to describe the PHR Business model and the chapter is written in such a way that it can be read loosely from all the previous chapters as a business model should be able to communicate the whole business logic in a limited number of pages. In this business model all the PHR-related findings, in the form of Critical Design Issues as Bouwman’s method of business modeling (7) prescribed, are put into the business model meta-model by Osterwalder (36).

At some points (especially in the paragraph about the revenue models) there are multiple options considerable and it just depends on the situation, preferences and predetermined choices of the company which of these options are actually applicable.

The business model for a Personal Health Record service looks like this:

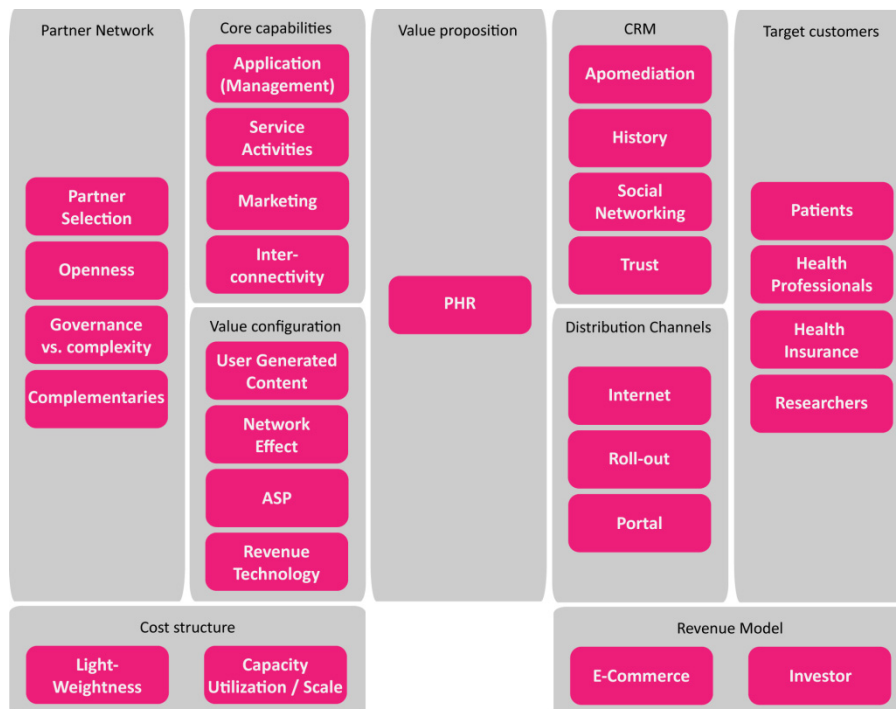


Figure 6.1: PHR business model

The following paragraphs shall address each of the critical design issues (CDIs) that need to be taken into account (depicted red in the picture above). The order is corresponding to the order Osterwalder (36) used to explain each element individually in his paper. The holistic view should give a general impression of the business logic required for introducing a PHR product into the Dutch market and can be used as a blueprint or basis for defining a more concrete business plan.

## 6.2 Value proposition

The value proposition describes what the company offers to the customer, in this case a description of the Personal Health Record service.

A Personal Health Record is an online application that allows patients to organize and share their health information by themselves. A PHR can be used to access, collect, track manage and share health information. A good way to explain how a PHR works is by showing it as a network as the picture on the right, The patient is the hub in the middle and creates an information network involving doctors, other patients and family regarding a certain treatment (the lines). All this information can be maintained and stored by the patient himself, obviously.

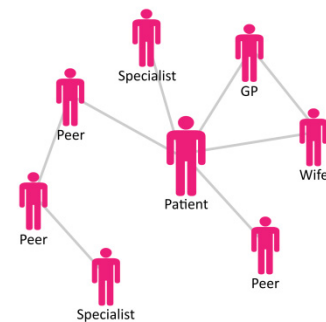


Figure 6.2: Role of PHR

The way experts talk about PHRs these days puts the focus stronger on the collection part (i.e. the patient centeredness in the graphic above) than the sharing part (i.e. the fact that these red lines in the graphic are *two-way* information flows). This view does not entirely give the PHR full justice, for every actor using the PHR, the most important thing is that information flows should start.

This health information can contain:

- Personal medical history (from EHRs, PHRs, XIS, EPD, etc.);
- Medical (lab) results / Measurements from treatments (tracking);
- Medication list / Immunizations / Allergies;
- Family medical history (genetic issues);
- Personal complaints / Personal preferences (organ donor, hospital food, etc.);
- Emergency information;
- Personal health community (who are your doctors, etc).

Because it is an online application the company that offers the PHR gets the role as ASP, which means there is more than just the application to worry about. The whole service needs to be taken care of: a website that suits the needs of the customer best, 24/7, etc.

Eysenbach (14) likes to call this a PHR 2.0, where the focus is not only on the aggregation and creation of content but also the social networking and content sharing is of equal importance. This social element is important to cause lock-in and make sure that the people who start using a PHR are at least motivated and interested enough to check into their PHR again on a frequent basis. Considering the Internet activities of the younger generation it would make sense to offer this “PHR 2.0” opportunity so that they can integrate the PHR into their virtual life and vice versa.

This 2.0 refers to what is more generally known as Web 2.0 and more recently these websites are being called Social Media. As opposed to traditional media (with a staff taking care of the content), Social Media exists on the fact that the users create the content and also share it with those who might interest for it. The typicalities of Social Media are important for a PHR service:

Term	Description
Social networking	Focuses on building online communities with people who share same interests or are interested in checking out other people their interests health wise. Users like to communicate and share information via their network. E.g. facebook.com
Aggregator	A piece of software that combines information from various sources into one place for easy viewing. In a world with multiple EPDs, multiple health professionals, having a way to aggregate information is desirable. E.g. google.com/reader



User generated content	Refers to media where the content (totally or partially) has been provided by the end-users. The process of obtaining the content is often called crowd sourcing or collective wisdom. E.g. wikipedia.org
Multimedia	Data can be more than just text, as there is also pictures, video or audio files that can be of equal significance to the patient. The ability to handle multimedia files is quite a requisite in modern Internet times. E.g. flickr.com
Syndication	Website material is made available to multiple sources using RSS or Atom with the underlying purpose that anyone can integrate and/or aggregate the material on their own (personalized) website. E.g. nytimes.com

Table 6.1: Social Media terms

The more connections a PHR offers with other data sources (syndication), the better. After all, a high level of interconnectivity is desirable as patients are unlikely to put in much information manually.

Several researchers showed that the main online demand of patients is *obtaining* information on illnesses, treatments etc. Results about actively putting information online themselves show quite varying results, usually with a big drop out. Which shows again the importance of interconnectivity and that certain incentives need to be given to actually use the PHR.

### 6.3 Target customers

A Personal Health Record has a few customers which it can target:

Customer	Role
Patients	Patients have a central role in the usage of the PHR. They make and manage the content. Patients get empowerment in the care process and the ability to have more control over their medical data.
Hospitals and Health professionals	Health professionals can improve the efficiency of their diagnoses and other primary processes; they can even practice "remote care" in some cases. Another need that health professionals face is the ability to share information with patients.
Health insurance companies	When health professionals optimize their efficiency, costs will drop or at least the whole service would improve. As health insurance companies pay for the care they have an important role in the financial side.
Medical research	The medical research world is very eager for getting statistics, demographics and similar information, therefore pharmaceuticals or medical research institutes are willing to buy such information if there is enough relevant information for them to understand their market.

Table 6.2: Target customers

All four target groups can benefit from a PHR. Targeting one is not enough, in order to make it a success multiple parties need to be enthusiastic, especially patients and health care professionals who are the primary users. Patients need to be motivated to use it carefully and on a frequent basis. Health professionals need to be motivated to incorporate the information from the PHR into their care processes and also deliver the patient with new information. Health insurance companies are important in the healthcare process as they control the money flows. This latter is why the Dutch healthcare system differs a bit from other healthcare systems, e.g. the American one that is strongly privatized.

#### Patients

Some facts: 80% of the Dutch people use the Internet, of which 50% use the Internet for health related activities, so that means 40% are potential PHR users. The main interest of patients is searching for information about conditions and treatments and the experiences of others with certain treatments.

The first users shall be a niche, people that can be typified as early innovators. These people have a big interest in trying a PHR service, are generally aware of its context and possibilities and are not representative for the entire population you want to provide service for. However, they are an excellent group to learn from as they will be criticasters who know their facts. Besides valuable input, these people will also be important for the spread of the product. If they like the PHR, they will tell others to use it and cause a positive network effect (vice versa applies too, obviously).

Patient illiteracy is an important aspect to take into consideration. Unlike the above early innovators, the vast majority of people are not that known with medical and technical terms. People differ in level of understanding and this is why apomediation (as Eysenbach introduced) is of great importance in order to facilitate the improvement of literacy.

The Maslovian pyramid indicates that optimal health does not have a high priority in the hierarchy of needs, which might explain the high drop out at E-Health applications. There is no high need for optimizing health processes in the eyes of patients and their main focus when it comes to Internet and health still lies in finding relevant health information. The popularity and needs for keeping a PHR are thus low; Eysenbach therefore described "the PHR 2.0" with a social element that joins in on the current hype of social networking on the Internet. It is not the only option however there are other ways to enrich the PHR to improve its attractiveness. E.g. Lifesensor offers a complete patient-focused healthcare service where patients online can make appointments with doctors, get online consults, join in on well-being programs initiated by their company, etc. All these features add up to a more frequently visiting user (lock-in) and a smaller chance of retention.

Generation Y, which is the generation of people born in the era of 1975-2001, are very active on the internet with their social networks and sharing multimedia. This generation will be a great target group for a PHR service as they would really see a purpose in maintaining their health information online and the ability to share parts of it with family and friends.

Patients are the central users of a PHR, therefore they are the most important group to motivate and stimulate regarding the usage.

### Health professionals

The main need for health professionals can be summarized in one word: information. More, better and actual information, either via the patient or via better integration and also the ability of sharing information inside the entire care process. Integration and actuality score so high because inside the care process of a patient (in most cases) referrals happen. E.g. a patient first goes to the GP who sends the patient through to the respective specialist after diagnosing what is actually wrong. Because of the poor integration of information systems a lot of redundant diagnoses take place every day.

The quantity and quality of information can be improved as patients can add valuable information themselves, e.g. historical information about illnesses that run in the family or patients can retrieve health information from certain helpful sources and share it with peers and their doctor or specialist.

Also the information going from the health professional to the patient can be improved a lot and is another vanguard a PHR can play a big role in. Health professionals *want* to share digital information with their patients, but this does not happen that much in the medical world yet mainly because the platform is not there yet. Some health professionals use email or give patients some URLs to check, but this information process can be improved a lot. For example, pre-visit inquiries or default information for common treatments can technically be shared with one simple mouse click.

The discord that health professionals have about the above explained information gaps is an excellent detail to address when introducing them to the PHR. Health professionals need to be interested in the PHR as well and getting their goodwill and support is important. If the health professionals (CDOs/hospitals more likely) understand how a PHR can optimize their processes internally, they might be willing to pay for the PHR service if that lowers their costs and improves their efficiency.

Google uses this customer segment by introducing Google Health to health professionals and hospitals and gaining their support in introducing it to the global market.

### Health insurance companies

Since 2006 Dutch health insurance companies are triggered to compete more and work more in a market (supply/demand) setting. Financially speaking the health insurance companies are the biggest and most important actor when it comes to PHR.

If nothing happens to the current situation in 2025 the number of needed employees in the health care industry *triples* and the costs will go sky high. Obviously a scenario health insurance companies (or anyone!) does not want to face therefore E-health might be an answer. A PHR offers the opportunity to make the care processes of healthcare professionals more efficient (e.g. less redundant diagnoses, more remote check-ups etc.) and therefore can cause a cut in the costs. If the cost reduction is significant enough, health insurance companies would be very willing to pay the ASP for offering the PHR service to their customers and contribute in the diffusion of the PHR among their user base.

Considering the financial influences of health insurance companies they have the ability to cut deals towards either the patient and/or the health professional to influence the usage of the PHR.

Targeting customers via the health insurance companies does bring up a new problem which is segmentation. Segmentation halts the positive network effect a bit. E.g. if you have an Univé insurance and your other half has an Achmea insurance and one of the two does not offer the PHR, for both parties the value of the PHR drops significantly (Metcalfe's law), for a PHR 2.0 that is undesirable. Also, from the perspective of health professionals this segmentation is annoying when some patients use it and other patients do not. So when this option is being used it is important that customers via a group of health insurance companies are targeted E.g. the 3 big ones cover about 8 million potential users, this makes sure the choice of potential relationships is high (enough).

Microsoft offers HealthVault to health insurance companies to mention it to their website and integrate it into their overall service and that way motivate patients and health professionals to use it.

### Medical research

Medical and pharmaceutical research is expensive business and they work with big budgets. Especially research into the effects of medication and trends of illnesses is very interesting to them. In a lot of cases these kinds of research is done in controlled situations and are therefore never 100% valid. A PHR offers the opportunity to monitor test persons in their "natural environment", therefore selling deidentified medical data can be lucrative business.

The downside is that this medical data cannot be sold without permission of the patient so the permission needs to be granted beforehand or the medical data needs to be retrieved on in a voluntary form (e.g. by using polls, inquiries, etc). Next to that, the statistical value is very dependent on the number of users as well so in the early stages of the PHR with a small user base, the data is not that interesting for research.

## 6.4 Distribution channels

Needless to say, the distribution channel is the Internet. The PHR is a web 2.0 application and will be publically<sup>1</sup> available via the Internet. But what is an important step is how the innovation shall be diffused; there are several options of roll-out. A properly chosen and executed roll-out is very important to make a service into a success.

There are a few options for a roll-out:

Roll-out	Description
Health portal or other E-Health application	One can use a complimentary application (or multiple) to 'wrap' the PHR service up in order to beef the service up in the eyes of the customer. A logical choice would be integrating the PHR with a (already successful) health portal or other (already successful) E-Health application that attracts visitors and guarantees lock-in as well. For example, the Lifesensor PHR also has an appointment making service or Microsoft HealthVault has a search facility.  If the customer uses any of these attracting facilities he is also more likely to use the embedded PHR application.
Health insurance companies	Health insurance companies have a lot of power in the Dutch healthcare system, as they control the money. Offering the PHR service via a big health insurance company or preferably a group allows the opportunity that the health insurance companies use their power to speed up the diffusion. E.g. by integrating the PHR into their policies and giving their customers discount if they use it and other similar financial constructions with the other actors as well. This policy is in line with the horizontally scoped strategic positioning Stabell and Fjeltstad mentioned.
Hospitals	Another roll-out method is by involving the users, in this case hospitals. Doctors and specialists have to incorporate the PHR into their primary processes and understand the benefits that the PHR can bring to their information needs. If they start to integrate the PHR in their processes it is likely that they will ask their patients to utilize it for their convenience. A problem is that doctors often do not get enough incentives to optimize their processes hence they do not pursue optimization either, because why bother?
Government assistance	The government can facilitate in spreading the PHR, whether they actually will is debatable considering their current affairs with the EPD. But they can practice similar means like spreading an informational letter on behalf of the government about the benefits of using a PHR. The government likes to see a efficiently functioning healthcare system knowing the upcoming problems and a PHR is one answer to those problems.
Positive network effect	The last but hard to control form of roll-out is by relying on a positive network effect. A small group of users (be it patients or health professionals) will try the PHR and if they like it, they will tell others to use it as well and the PHR will spread gradually among the population. When this form of roll-out is chosen, marketing will be a very crucial core competence.

Table 6.3: Options for roll-out

### Portal

A few PHR initiatives are more than just a PHR but rather a health portal. These websites offer apart from PHR facilities also the ability to search for all kind of health information in a centralized, organized way. As it is known that patients mostly use the internet to search for health information it is a good way to attract users to the PHR. Health portals were one of the first E-Health business models to appear as Parente showed.

## 6.5 Customer relationships

The PHR creates a few relationships with the customer, in this case the patient.

<sup>1</sup> How publically depends on the revenue model however

## Apomediation

This term describes how a tool can take up the role as intermediary from the health professional. There are three forms of mediation:

- Intermediation - e.g. the traditional doctor-patient relationship;
- Dismediation - e.g. a patient using Google to find health information;
- Apomediation - e.g. a patient using a specialized health portal to find health information.

So basically it is somewhere in between intermediation and disintermediation, there is no actor in between, just a tool that steers the information into the right direction. A PHR offers a structured environment where the patient himself can manage and share his medical information in a proper way. This apomediation has a lot of parallels with the E-Business opportunity 'information brokerage' that Timmers described; the PHR can help the customer find a way in all the available information.

Also if the PHR gets a search feature or information feature on certain health topics, it can also direct the patient to adequate information. This is another point one can focus on to make the PHR more attractive to the patient.

## History

Another relationship is the ability to help the patient create and restore his medical history. Often redundant diagnoses take place, as doctor A did not see what doctor B already did. Every doctor keeps his own medical files and there is not an all encompassing chronologic file about a patient, which is odd. This "legacy of disconnected information" is currently a problem that needs to be fixed as i.e. other markets (for instance a bank) seem to know far more and thorough details about their clientele than the healthcare market. Information systems need to be connected but even if modern information systems get connected a lot will still be missing. Therefore it would help to give the patient the opportunity to restore his history by allowing him to fill in the gaps as they know better what crucial information is missing. This is also in line with information brokerage.

## Social networking

A PHR creates a social network for patients and health professionals. The ability to share your PHR information with others and by allowing getting information from others inside your PHR you create a virtual community around yourself. This community could entail anyone whom the patient finds interesting enough to share information with, from doctor to granny to alternative healer to dentist. Timmers described the Virtual Community where a company provides the opportunity to customers to form a personal community and due to interdependencies provides the company with a huge network, which is a valuable asset<sup>1</sup>.

Social networks are booming business on the Internet with websites such as Hyves and Facebook that occupies a lot of people in their free time, incorporating the PHR within the virtual life of a customer triggers the customer to use it more than when it is just a standalone tool.

Another option what social networking introduces is collaboration. User generated content in combination with the strengths of crowd sourcing to create and lift the quality of information is a new form of business that is currently also rather successful. For instance Wikipedia shows how internet users collaborate on creating a worthy encyclopedia. Crowd sourcing possibilities also lie in the healthcare world where experienced peers would like to collaborate on providing information for new patients etc in order to guide them through the same phases they already had to go through.

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<sup>1</sup> More on this at the revenue model and then specifically the community model

## Trust

The privacy of information on the Internet is an arbitrary concept considering how certain youngsters basically put their entire life (e.g. diaries, holiday pictures, what stuff they buy etc) online. They do not really seem to care, either because they are ill-informed how a few holiday pictures could harm their privacy or simply because they do not care. This is a wrong course and there are government initiatives to inform people about the dangers of putting your entire life online.

Traditionally speaking, health information is something you do not like to share with everyone and thus has a special level of privacy, there are a lot of taboos. E.g. your neighbor does not have to know you have some STD because then he will look weird at you when you get the newspaper or the building company you work for does not have to know you have weak knees because they will fire you as soon as they need to reorganize. The examples may seem silly, but taboos are still built-in in our culture. These taboos combined with the doubtful trust in the Internet (hackers and what not<sup>1</sup>) creates a lot of scepticism regarding putting health information online.

Timmers (48) described so called trust services which are companies that put privacy, security and confidentiality as high priority and so giving their customers the comfort knowing that their information is in good hands. This is where Google gets most of their criticism targeted at, knowing that they analyze *everything* from their users in order to improve their advertisement logic.

Marketing and PR is important to gain trust especially something in the likes of: Other parties cannot fiddle around with your health information but you will control it yourself.

## 6.6 Value configuration

What determines the value of the PHR?

### User Generated Content

Patients fill up the content of their PHR themselves either by importing data from other EHRs and medical databases or by manually adding medical details and personal inputs. Because the users fill up the PHR with content they are also the value-determining factor of the PHR. The vendor needs to focus making it as easy as possible for patients to add content, but at the same time, making sure the quality is high yet the input is not too restrained. Obviously the quality needs to be high as medical information is not something you want to have errors in or to be tampered with. Medical information does not exactly leave a margin for error.

User generated content is a controversial subject where a lot of content has been generated about already on blogs, forums and also in traditional media but the clue is that some people are very critical about it, they claim its truthfulness, correctness, quality, privacy and property (e.g. why Creative Commons was initiated) is arbitrary.

In order to have content generated by users, you have to rely on their engagement and willingness to create information. According to recent Forrester figures, 60% of the internet users consume user generated content and 48% creates it but these figures are climbing to respectively 70% and 52% in the next 5 years.

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<sup>1</sup> They can obtain this information already one way or another after all, e.g. hacking into the LSP would be a more logical choice.

## Metcalfe's Law ( $N^2$ )

Metcalfe's law applies on every service that requires a social network to diffuse itself. A PHR is also dependant on the willingness of patients to use it, the willingness of health professionals to incorporate it in their primary processes and thus the whole network of people using it. E.g. it would be inconvenient if your doctor does not use it or that everyone you know does not use it, then the perceived value of the service is low especially when social networking is an important vanguard of the PHR. It is like being the only one with a phone in the world, but what is the use if you have no one to call?

What Metcalfe's law implies is that the value of a network is dependent on the number of potential relationships one user can initiate. This number of potential relationships is quadratic to the number of users. The more potential connections and the more interconnectivity, the more interesting the PHR becomes in the eyes of all the actors.

## Application Service Provider

Unlike traditional IT, ever since the Internet becoming an important distribution channel for goods and services the role of the company needs to be different as well. In the 90s you created an application, sold it to customers and had perhaps some support services. But things have changed. A web 2.0 application is not just a piece of software, it is a whole service. Things like uptime, backups, security, sufficient bandwidth etc are all elements that will influence the perceived value of the customer and should not be overlooked.

Healthcare innovates with IT a lot slower than other fields and thus a lot of healthcare organizations still have the old fashioned view on IT or barely began to see the possibilities of doing things online. So people, internally and externally, need to know that there is more to a PHR than just an application and that the service is of equal importance. This view needs to be adopted into the business model, in other words, the traditional business needs to change to E-Business.

Points of attention that an ASP needs to be aware about are mentioned in the E-SERVQUAL framework by Para

## Revenue technology

The aforementioned ASP business model implies that there are a lot more and different options than just the sales of the application. There are other revenue models possible often referred to as E-Business. These revenue models require a certain technology, not only to make the revenue flows happen but also to optimize the revenues of course. An aspect that is quite often overlooked by many Web 2.0 based firms as they did not evaluate thoroughly what the possibilities are. Most choose for advertisement out of its easiness and as it is run-of-the-mill currently.

## 6.7 Core capabilities

What capabilities are required to offer the PHR service?

### Application

Based on the quick scan of the market, there are already PHR products in existence which means there are a few options regarding the application:

Option	Description
Development	The PHR application shall be developed conform the needs and requests of the ASP, either in-house or outsourced.
Acquisition	An existing PHR application will be bought from a third party and slightly adjusted to the needs and requests of the ASP.
Partnership	This construction requires a deal with a third party PHR supplier that sees a benefit in cooperating with the ASP.

Table 6.4: Options for application

These options all three have their pros and cons depending on the ASP, we will continue to elaborate on the 'development' part as when an organization chooses for acquisition or partnership the evaluation of the PHR can be slightly based on the requirements of development. In other words, if the last two options are cheaper and/or qualitatively better than the development, it is a logical choice not to develop the application yourself.

When it comes to development it is important to understand the users. As O'Reilly described with Web 2.0, the users need to be treated as co-developers. Especially in the early stages of the introduction of the product contact with the lead users is recommendable. These users are aware of the jargon, technology, possibilities and probably tried other PHR products as well and therefore can contribute insightful opinions to improve the service.

Another aspect O'Reilly (34) explains about the development is the need for 'light-weightness'. This term reflects almost everything that is involved:

Lightweightness	Description
Light on Time	<ul style="list-style-type: none"> <li>Spend as little time possible on a problem;</li> <li>Be immediate, dynamic;</li> <li>Add features in short leaps at a time.</li> </ul>
Light on Complexity	<ul style="list-style-type: none"> <li>Only add what's directly needed;</li> <li>Use common, open technologies.</li> </ul>
Light on Formalities	<ul style="list-style-type: none"> <li>When something needs to be done, do it;</li> <li>Bring in little hierarchy and paperwork.</li> </ul>
Light on Infrastructure	<ul style="list-style-type: none"> <li>Minimal, but optimal technology;</li> <li>Outsource when it isn't core business or cheaper.</li> </ul>
Light on Costs	<ul style="list-style-type: none"> <li>Keep costs minimal;</li> <li>Use free (open source etc) options.</li> </ul>

Table 6.5: Lightweightness

## Service Activities

Stabell and Fjeltstad (45) described primary and secondary activities for a service organization. The primary activities are:

Activity	Description
Service provision	The main activity obviously is providing the service in the first place; making sure the links between actors can be established, maintained and terminated plus with a reward for the service provider.
Contract management	In order to create interconnectivity it is important to establish contracts with (key) actors to stimulate the usage and value of the content. Also in case of cooperating with 3 <sup>rd</sup> parties, these contracts need to be taken care of as well.
Network promotion	Marketing is very essential for the success of the PHR. The next chapter will go into more details.
Network infrastructure	The technology and connections need to function optimally regarding reliability, responsiveness, accessibility, credibility, privacy, etc.

Table 6.6: Primary activities

Secondary activities that need attention to guarantee the continuity of the PHR:

Activity	Description
Service development	Making sure that the changing demands of the users (patients and health professionals etc) are met plus also keeping the service technically up to date with the latest market trends.
Network development	Also the network, technically as its population, needs to be expanded and to do this more network promotion is needed and a better network infrastructure.

Table 6.7: Secondary activities



## Marketing

One activity that really stands out when it comes to PHRs is marketing. Network promotion and informing all actors of the Dutch healthcare system what the purpose of using a PHR is and what benefits it will bring for them is very important in order to make the PHR a successful application.

A few points of attention when it comes to marketing the PHR:

Point of attention	Description
What is the gain?	<p>As said a PHR can give benefits to all partners in the healthcare network, given that they are willing to cooperate with the initiative. Communicating these benefits is the only way of motivating them to cooperate.</p> <p>This question seems silly but especially at the patient-side people really have no idea what benefits a PHR can have. In fact, the majority does not even know what a PHR is let alone its purpose for their healthcare activities. Patients need to understand the relative advantage.</p>
Security	Gaining trust is important for medical information, although the younger generation of users would have less problems adding personal information to a PHR there are still a lot of others who do not. Addressing the security of the data is important especially after the somewhat poorly received EPD that especially on the security aspects gets a lot of criticism to endure.
Key actors	There are a few visionary persons when it comes to PHRs in Holland and getting their support will help with the diffusion of the product among the more conservative key actors.
Groups	<p>A PHR diffuses best through homogenous groups which are groups that have something in common and therefore communicate new possibilities internally and gives a social incentive to the PHR.</p> <p>Concretely, this means addressing a group of healthcare customers, e.g. all clients of a certain health insurance company, will be much more efficient than addressing people in a more general manner.</p>

Table 6.8: Marketing

## Interconnectivity

Another important activity is creating interconnectivity, connecting social and information systems with the PHR. Research showed that internet users (and patients also) are mostly *consuming* content rather than *contributing* content (about fifty-fifty) therefore automated services to obtain information from multiple sources to integrate that into the PHR is favorable. As Parente described (37), there is a need for E-Health connectivity. A need to connect health related information systems with one other and aggregate the data. A PHR does just that with the patient in control.

*"When consumers are comfortable with an activity, such as they were with searching for cause and treatment information, their perceived effectiveness is higher, their trust is higher and their likelihood to exhibit desired behavior is higher—all by significant margins. Sites that expect end users to perform activities that are less familiar than healthcare information searching are going to have to be simpler and easier to use."*<sup>1</sup>

The quote above shows why the word automated is purposely used. The manual input of patients is pretty limited when it comes to adding medical data hence the need that patients can do this with just a few mouse clicks.

<sup>1</sup> <http://www.changesciences.com/Reports/Site-Type/Healthcare/Public-Healthcare-Web-Site-Survey>

In practice, there is continuous interconnectivity where a link gets made between an information system and data gets updated frequently (e.g. the heart monitors) or just one time interconnectivity where for instance a patient pays a fee to get all his medical records converted and imported into the PHR.

Social behavior is more likely to occur. Connecting the PHR with social systems will give it the important social element and create a more interesting environment for the users. For instance the possibility of exporting (personal) fragments of the PHR to websites such as Hyves, Twitter or Facebook is something that current internet users would appreciate and are services other information carrying websites already offer.

## 6.8 Partner network

Which contacts should be made with other parties?

### Partner selection

The first step in creating the partner network is selection which partners are a possible candidate to select. The target groups already give a good indication with whom partnership can be arranged. In fact, it can be a bit arbitrary to speak of target customers and partner network individually as in many cases, an actor can play both roles equally importantly. It depends on the (in)directness of a customer\partner in the revenue generation to speak of either a customer (direct) or a partner (indirect).

Partner	Description
Health professionals	Health professionals need to incorporate the PHR in their daily routines and activities otherwise there is not much use to it, therefore they should be seen as partners. The ability to swap information easier with patients is something they can find interesting. A more efficient use of their time is something they do not directly find that important, as they lack incentives.
Hospitals	In order to get health professionals on board with the PHR service, addressing hospitals to incorporate the PHR into their services is an important step. They can give health professionals the incentives to use it and to make their care processes more efficient and of a higher quality with the information sharing..
Health insurance companies	This partner has the most power in the network as after all it still revolves around money. So if any partner can enforce anything it are the health insurance companies. Next to that, they will benefit the most from optimized care processes as they will entail potential cost reductions.
Government	The government can support in two ways: helping with legislations and standards, there are European and Dutch standards that explain how a PHR should work and that offer potential connections with EHRs and other information systems. The other way is financially, e-Health is a hot topic and there are several ways to get funding for interesting projects. E.g. successful small pilot projects can apply for a fund to scale up to a national project.
Other EHRs and PHRs	In order to get interconnectivity the PHR needs to be hooked up with other EHRs, PHRs and other medical data carriers that are relevant for the PHR. For this partnerships (and connections) have to be managed.
Pharmaceuticals	Pharmaceuticals are interested in the effects of their medication on people in their natural environment, this information can be monitored via a PHR if the patient allows it, next to that pharmaceuticals can use the PHR as a platform to promote themselves.
Well-being products	The PHR can be a platform to get patients into contact with well-being products which can range from diets to bikes to orange juice. So this partnership mostly relies on advertisement or affiliation.
Medical technology	Medical home equipment these days get features so they can upload measurements real time to a computer and again, the PHR can be a platform to host these measurements.
Other E-Health	Plenty of other E-Health applications already exist and depending on how open the vendor wants his business model, the company could allow others onto the PHR platform to practice their business just to improve the overall customer experience for the PHR as a whole.

**Foundations**

Foundations can use the PHR to create awareness for certain illnesses and perhaps foundations can help in making the social element, of sharing experiences etc with peers a lot more interesting and worthwhile.

Table 6.9: Partners

**Openness**

Openness improves the interconnectivity however raises the question: how easy do you allow third parties onto your network? The pros and cons mostly lie in the area of “who owns the data”, however more and more media companies already choose for the open approach. A good example is the complexity of copyrights in social media with creative commons licensing and similar constructions.

Openness of the partner network however tend to pay off well in some cases, take for instance Ryanair that outsourced almost every part of the service around a flight but the actual flight itself. In modern business this openness thrives well even though plenty of conservative companies still do not like the idea of giving away control. In relation with the whole Web 2.0 philosophy and the freedom of flowing information, openness is favorable with PHRs as well. An interesting question to raise here is, *can* certain medical data be open and how? And obviously there still needs to be a way to make money for the vendor company despite the openness.

**Governance vs. Complexity**

The more partners, the more complex the partner network gets and the more governance is required. According to the Web2.0 philosophy (34), everything should be lightweight and therefore complexity should be avoided. At the same time interconnectivity asks for the more connections the merrier, which raises the complexity. There is a tension here and the governance should focus on keeping the connections standardized and interchangeable to make the governance of the network as light as possible yet still allows the possibility to offer the maximum interconnectivity.

**Complementaries**

Complementaries are a special form of revenue generation described by Rappa (38) but they also have a role as partner. Complementaries are products or services from third parties that the vendor offers on his PHR and with that construction the vendor creates a win-win scenario for both companies. The revenues in itself is only part of the medallion as there is also extra value addition to the service. A good example is the heart monitoring that Microsoft offers: This heart monitoring makes HealthVault much more interesting for people with heart conditions as the PHR connects with their heart monitor and at the same time the company that sells these heart monitors gets a sale boost plus can say they are compatible with HealthVault (marketing).

Another example is [nomoreclipboard.com](http://nomoreclipboard.com): they offer the opportunity for patients to import medical data from several sources into their PHR. [nomoreclipboard.com](http://nomoreclipboard.com) gets money for the important and the PHR becomes more valuable at that point as it contains medical information that the patient cares about.

**6.9 Cost structure**

What determines the costs?

**Light-weight**

The web 2.0 philosophy introduces light-weightness as the main cost driver or rather the solution to keep costs at a minimum. In order to keep costs at a minimum, the business should be kept at a minimum also. This has some implications for already existing companies that already are of a certain size. The projects should pursue light-weightness still otherwise competitors can do it more efficient and cheaper.

## Capacity utilization and scale

Stabell and Fjeltstad (45) stated that scale is a potential revenues and costs driver. The more popular the PHR becomes, the more it gets used and the more technical facilities are needed to keep on delivering a qualitative good service and on the other hand more users means more revenue generation as well, if the revenue generation is connected to the number of users or usage. The number of technical facilities should be well balanced that it is not becoming a costs hog but at the same time sufficient to keep the quality high enough. This leveling is known as capacity utilization and normally a level of maximum 85% is favorable to be able to anticipate a sudden heavy usage/demand.

Hosting facilities usually charge extra when limits are exceeded. If this happens frequently, upgrading the capacity might be wise.

## 6.10 Revenue model

How can revenues be generated?

There are various options to pick and even combine. It depends on choice of the vendor (and prognoses) so it is impossible to suggest just one revenue model. As the PHR is an Internet service looking at E-Business possibilities is a logical step. Most revenue models described here are of a Business-to-Customer (B2C) nature, but considering the slightly different market that the Dutch healthcare market is it also makes sense to look at hospitals and health insurance companies as an option and therefore taking a Business-to-Business (B2B) approach.

## Community Model

There is also a special case business model not directly related to revenue generation itself called the community model. Eysenbach (14) pointed at the importance of the social element of a PHR. Rappa (38) confirms this and points out those social activities create lock-in and cause a positive network effect. The community model is not a revenue model in the sense that it does not directly generate revenues. The value here is the network itself. If you create a community and this community is worth money. By doing exactly what the community wants, the community expands and you create a big user base. This user base can be fruitful for (marketing) research or similar group-based activities.

A community model does not necessarily mean you cannot generate revenues, some forms of revenue models can fit, as long as the main service allows the community to grow which in most cases means the service needs to be (partially) free.

## E-Business

E-Business is doing business electronically on the internet. The revenue possibilities for a PHR are:

- Advertisement
- Subscription
- Sales
- Affiliates
- Infomediary

## Advertisement

Advertisement has two options, either you implement a third party advertisement system or you arrange advertisement deals yourself. The latter often has a bit higher pay-off as you can look for niche advertisers. In this case, companies with interests in the healthcare community.

Still generally, online advertising has a low margin and it is very dependent on the use. Several sources claim a good implementation can generate about \$20 or 15 Euros per 1000 views/impressions. It is realistic to anticipate that the number of patients that use a PHR will not be massive in the beginning and it is also realistic to anticipate the usage frequency will not be as e.g. a website like Hyves or Facebook who do billions of page views a day. Instead, the usage will be pretty centered around treatments that patients face and in between rather low.

As an example of the low margin, even if you have the entire e-Health market using the PHR and they visit the PHR about 50 times a year (which is a very optimistic estimation), it still generates only about 3 million euro. For a very light-weight company this might be lucrative but for a bigger company it is uninteresting (especially relative to the costs and other possibilities) and not a realistic option.

Pros	Cons
The PHR can be a free service and therefore be open for a big potential user base.	Advertisements can be intrusive and annoying the users.
Easy to implement revenue system, especially when choosing the third party advertisement system.	Revenues have a strong dependence on: <ul style="list-style-type: none"> <li>▪ Number of users;</li> <li>▪ Their visit frequency;</li> <li>▪ Pool of potential advertising possibilities.</li> </ul>
	Very small margin per view.

Table 6.10: +/- Advertisement

Another point of attention with advertisement is what advertisement gets shown. It would be distasteful to see advertisements of life insurances when you are very ill and checking your PHR and similar tackiness should be avoided.

### Subscription

Subscription is also an option to generate money. There are a few possibilities in this area that might work with a PHR: full subscription and partial subscription. The full subscription is what e.g. Lifesensor does, they charge an annual fee of 60 Euros to use their PHR. Considering the research done by Adler (1) this fee is very high and it seems very unlikely that a lot of people are willing to use it. According to Adler, the majority of the patients do not wish to pay more than 20 dollars for online health services and in fact, half of them even wish not to pay at all.

A problem that full subscription introduces is the fact that it does not work well with social media. Social media its existence relies on public input and a network, therefore the more people who are part of the network, the more valuable the network (and content) gets, if you charge a fee for joining that network a lot of people will not join. According to Adler about half of the patients are not really willing to pay money for online applications and Dutch research found the same tendency.

Pros	Cons
The revenues are usage independent. When the usage is lower (and thus costs) than the fee, this gives a margin.	Limited user base (50% isn't interested). Smaller user base also halts the positive network effect.
Ability to calculate a costs-covering fee per year.	No ability to try-before-buy.
	For paid services users expect additional features.
	The revenues are usage independent. When the usage (and thus costs) exceeds the fee, this can be bad.

Table 6.11: +/- Full subscription

A solution for that problem might be a new construction that is gaining popularity within E-Business which is called ‘freemium’. An online service offers its core features for free, but in a limited way so that users who really use the service a lot and intensively will find the need to upgrade to a paid premium account. Currently a few big websites, for instance YouTube, are exploring whether or not to go with this ‘freemium’-concept. A ‘freemium’ PHR can still make the PHR socially attractive and still generate money from the people who really see a benefit in using it, the basics of the service is still free, so people are still willing to join up and use it. Possible premium content ideas are: the ability to use more than 1 medical record, the ability to upload social media (photos, videos, audio), expand the network to more users, etc).

This ‘freemium’ concept also is in line with the need for triability, as Sarahsohn-Kahn (39) described, patients prefer to try a service free of charge and first unconditionally form an opinion whether they fancy it or not.

Pros	Cons
User base will be less limited so network effect still occurs.	According to research in social media, 1 of every 10 users might be willing to get a premium account. So a few have to cover the costs of many in a tenfold division. 90% will be “Free-riders”
Ability to try-before-buy.	For paid services, users expect additional features.
The revenues are usage independent, when the usage is lower (and thus costs) than the fee, this gives a margin.	
Ability to calculate a costs-covering fee per year.	

Table 6.12: +/- ‘Freemium’ subscription

Another perspective on the subscription is that not the patient but the healthcare professional or the health care insurance companies pay on behalf of the patient, either on an individual basis or by bulk. Considering the structure of the Dutch healthcare system, letting the health care insurance companies pay on behalf of the patient seems a logical construction.

Pros	Cons
Reaching out to homogenous groups, which allow the innovation to spread at a higher level.	You cannot reach all patients, so segmentation will occur and this segmentation will be a bottleneck for the network effect. E.g. Doctors will have patients who use a PHR and patients who do not. That causes dualism.
The PHR gets support from 3 <sup>rd</sup> parties, they can help financially and with marketing.	Contracts and arrangements need to be made and this shall be a costly and time consuming process.
The growth shall be gradual.	

Table 6.13: +/- Subscription via third party

## Sales

Selling the PHR *itself* to the patient is no realistic option as that is against the philosophy of Web 2.0 and the role of Application Service Providers. However there is an option to sell interconnectivity opportunities in order to generate revenues. As a PHR needs to be filled with information and also information needs to come out of it towards healthcare professionals, these two flows have transformation opportunities.

Both Google and Microsoft outsourced these importing and exporting activities to third parties. For instance, mediconnect.com charges 98 dollar to collect and convert all medical data they can find about a patient and puts that into the PHR. Companies like mediconnect.com does not exist yet in Holland, as there is no clear PHR initiative in Holland, so incorporating these activities into the PHR offer is a potential form of revenues.

Pros	Cons
Costs covering fixed price can be charged relatively to the usage (e.g. monthly updates)	No revenues directly linked to the PHR itself.
If patients make these expenses, they find the PHR a valuable asset and they shall use it in a serious manner.	Extra activities that are not directly part of the core business around offering a PHR.
	Dependant on the openness of other information sources, perhaps even financial arrangements need to be made.

Table 6.14: +/- Sales to patients

Selling the PHR to healthcare insurance companies or hospitals might be an option too so they can incorporate it into their services, this is pretty similar to the investor suggestion described later on, where hospitals or health care insurance companies pay by bulk for the PHR, but it can also be on a patient-based level perhaps and then it makes more sense to speak of sales.

### Affiliates

Affiliates is a revenue model where you involve third parties into the revenue generation process, in other words, it is indirect as *they* generate revenues and pay a fraction of their revenues back in return for the publicity or adverts placed on the PHR. There are three options for affiliating:

Affiliation	Description
Banner Exchange	Social networks want to hook up with other social networks to expand their (potential) user base. So by putting a banner on a different social network, these users might want to join up the 'new' network as well. For every new user or for every click, the company pays a fee.  There is also the possibility to do it free, this way both parties just want to show they cooperate and give their customers to use each other's facilities. For instance Google Health gets shown on websites of hospitals Google has made deals with and Microsoft is doing the same with American health insurance companies. A banner exchange can speed up the positive network effect.
Pay-per-click	Pay-per-click is a 'sponsored' link. Instead of a company that pays for just showing an advertisement, the company pays when the user actually clicks on the link. Usually PPC fees are higher than regular advertisement fees, yet the likelihood a customer clicks can be low.
Revenue sharing	Other companies can offer their products and services on your website and make deals that they share a percentage of their revenues in return. Potential candidates in this area for PHRs are: well-being products, medical home technology, sports, etc). Also here, the likelihood that a customer orders such a product or service can be low.

Table 6.15: Affiliation types

Pros	Cons
Affiliates offer higher revenues than regular advertisement.	The revenues are indirect, so a patient first has to click or even order a product before there is any revenues.
Affiliates can be a partner when it comes to popularizing the PHR.	Dependant on image and reputation of 3 <sup>rd</sup> parties.
	Requires contracts and arrangements which will take more time and money to arrange than e.g. regular advertisement.

Table 6.16: +/- Affiliates

### Infomediary

The last E-Business model is the infomediary and based on the ideas of the community business model. In the current information age information is worth money and this is what an infomediary revolves around. An infomediary sells information that it obtained from his community. Especially in the medical world information can be very valuable, for instance statistical data gathered from test users in their normal home environment.

There is a catch however. Medical information has strong privacy legislations so patients need to grant permission that their information is used. There are also other possibilities to avoid the privacy matter, e.g. by offering polls and questionnaires on an opt-in basis instead of data mining.

Pros	Cons
Revenues created by infomediary activities can be quite high given if the information quality is high.	The PHR needs contain valuable information that is worth selling. In the early stages of the PHR it will not be interesting as there will be little users and little information available.
Could be an interesting extra way of creating revenues in combination with a different revenue model.	

Table 6.17: +/- Infomediary

## Investor

Last revenue option that is left to discuss is the option of finding an investor. An investor is a company or group of companies that benefit from the PHR service and are willing to invest money in it. This construction is not specifically a type of E-Business, but more in line with the community model. But in the Web 2.0 world revenues via investments (acquisitions or risk financing) happen quite a lot.

Investor	Description
Health insurance companies	Health insurance companies can profit a lot from more efficient care, so they might be interested to invest in projects that will create this efficiency. Next to that they can expand their services with the PHR, which marketing wise might be interesting.
Hospitals	The need to empower the patient and to be able to better inform patients is growing and becoming more and more important, therefore hospitals can be a potential investor. With the growing tendency of patients becoming more selective, offering facilities that create binding is also a benefit.
Government	The government might see a future in a national PHR and can be willing to fund the initiative. The likelihood that they will is debatable considering they are currently still busy with the EPD. However, the European Union wants to stimulate e-Health practices.

Table 6.18: Potential investors

What needs to be decided with the investor(s) in question is whether to go for a construction where the investor(s) pay an annual fixed fee or a per-client/usage based variable fee.

Pros	Cons
In case of variable fee, the revenues are connected to the usage. No need to offer maximum service, but it can scale along.	Strong dependency on 3 <sup>rd</sup> parties.
Investors can be a partner when it comes to popularizing the PHR.	You cannot reach all patients, so segmentation will occur and this segmentation will be a bottleneck for the network effect. E.g. Doctors will have patients who use a PHR and patients who do not. That causes dualism.
	Contracts and arrangements need to be made and this shall be a costly and time consuming process.

Table 6.19: +/- Investors



## 6.11 Validation of the PHR Business model

In order to validate the PHR business model, parts of it has been discussed with experts within that area and the whole business model has been presented and discussed internally in front of an innovation board. The suggestions and additional literature that emerged from these discussions have been incorporated into the report and the assumptions based on interpolating theoretical findings to the particularities of a Personal Health Record have been confirmed and thus validated.

Experts who had a significant role in validating or contributing to the research: (alphabetized)

- Benthem, J. van
- Brake, H. ter
- Deterd, H.
- Furore (presentation on PHRs from a hospital perspective)
- Gemert-Pijnen, L. van
- Groothuis, B.
- Hel, H. van der
- Hoek, I. van der
- ICT Zorg (congress about business models in healthcare)
- Kana, J.
- Nienhuis, H.
- Nijland, N.
- Wagenaar, J.

# 7. Conclusion

At the end of the research, several conclusions can be made. They are divided in conclusions regarding Personal Health Records, the business model itself, a reflection on the research and finally some subjects for further research.

## 7.1 Personal Health Records

Many not-so-much-different definitions for Personal Health Records go around as every application seems to have its own definition for it. In the scientific area usually the definition by Markle (26) gets adopted or referred to. As an addition to Markle and Tang (26, 46) their research into PHRs, Eysenbach (14) speaks of a PHR 2.0, where the social element is of high importance and patients can share their medical information with anyone they want. Considering the current Web 2.0 revolution, a PHR 2.0 fits the zeitgeist.

So what is a PHR then? The best way to see a PHR is to see it as tool to facilitate a personal temporary (as long as the treatment takes) medical information network with the patient as hub in the center. Information flows are shared by the patient among doctors, specialists, family members, peers and whoever might be relevant in the eyes of the patient. This part 'shared by the patient' is also very important and typical for a PHR as it puts the P in PHR. Not only does this give the patient the patient empowerment he needs, it also allows the patient to make the decision himself what and what not to share with others. For example the EPD did not place that decision in the hands of the patient and caused a lot of privacy distress.

When the treatment is completed, all documents, communication and whatever information flows took place, gets stored in the PHR to create a complete medical history of each patient. This history can be useful later on when an illness reappears or in similar situations.

## 7.2 The business model for Personal Health Records

As Osterwalder (36) described, a business model can have many purposes. In this research the purpose of the business model was mostly the ability to *understand* what business logic is applicable on a Personal Health Record. The understanding of business (logic) around E-Health applications is still very limited and so also for Personal Health Records. There is very little scientific research in this matter and in the empiric world a lot of the applications are put in the market based on gut-feeling or a simple market(-demand) analysis. What this business model for Personal Health Records does is creating the opportunity to understand and share the wholesome business logic. First of all towards the management of Pink Roccade Healthcare who can use this document to get informed about Personal Health Records and see its business opportunities. Next to that, there is also the scientific relevance where this business model is one of the first business models described for an E-Health application. Hopefully in the near future more scientific business models for E-Health applications emerge and the thoroughness and completeness of this business model becomes clearer. Currently there are not enough business models for E-Health and Personal Health Records specifically available to do this analysis.

Another important aspect is the sharing of this business model. One of the key conclusions is that a Personal Health Record can only become successful (nationally but also even regionally) when there are other partners who help in the spreading of the innovation. Not only does the innovation diffusion model by Cain and Mittman (8) imply so, also other PHR initiatives, such as Google Health and Microsoft HealthVault seek out coalitions with other healthcare partners.

I.e. government is a very important partner herein, especially in the early stages of the product when there are no dominant standards, guidelines and partners – basically the stage PHR initiatives are in today. The government can help in this situation by setting standards and persuading other parties to join in on the Personal Health Records project, but this also requires that the business model is easily shared with those who are interested. Another important partner, possibly even an investor, can be the health insurance company / companies that are interested in Personal Health Records, also in this case the ability to share the business model with them is then of high importance.

The business model for Personal Health Records gets fully described in chapter 6, however there are some important findings or conclusions from the business model for Personal Health Records:

A vital question for a business obviously is ‘who is the target customer’? This question has two answers, first the financial one: There are quite a few options which might be willing to pay for the Personal Health Record. Interestingly, unlike in the U.S., it seems unlikely that the patients are willing to pay for it. This is mainly due to the different healthcare system that the Netherlands have in respect to the U.S. healthcare system that is much more privatized while in the Netherlands the patients expect the health insurance companies to cover the health expenses. In the Netherlands most non-free (free in the eyes of the patient) E-Health applications have been a failure.

Either hospitals or health insurance companies therefore seem a more logical choice to pay for the service indirectly on behalf of their patients. They both might be interested in a Personal Health Record as it can improve their services and reduce the costs of treatments. This cost reduction can be a worthwhile investment.

Then the non-financial answer to the ‘who is the target customer’-question, which is perhaps even more important: all actors are important *users* of the Personal Health Record and a Personal Health Record cannot become valuable without them (e.g. the relevance of the network effect shows here). A patient needs to understand what good use a PHR can have for his treatments and needs to use it, a doctor needs to get incentives to use the PHR in his treatments and hospitals and insurance companies need to support it. This step is complicated and exactly why the government can be important with setting standards and legislations, hence then it is perhaps better to speak of a partner instead of a customer.

The healthcare system is more complicated than ‘regular market-driven commerce’ and money flows are really complex and sometimes even quite unclear for instance due to budgets and declarations, which makes forming partnerships equally complex as these complications need to be dealt with. Again this shows that government input or a good partnership with health insurance companies is a must.

The importance of the users can also be seen when looking at the value configuration, here another important notion has to be made and that is that the users create the value of the content and thus the value of PHR service is dependent on their usage. The more users, the more valuable the PHR becomes, also known as the network effect or Metcalfe’s Law. The quantity of users is important for the social aspect of the PHR. Sharing medical information only works if both parties actually use the PHR. E.g. from a patient’s perspective, if doctor A uses the PHR but doctor B does not, the PHR is only half as valuable to the patient as it potentially could be.

Patients and healthcare professionals will only use the PHR in their healthcare processes if they understand the additional value a PHR gives to the treatments. Stabell and Fjeltstad (45) already state that network promotion is one of the key activities for a service providing company. Again, partnerships to promote the network among patients, healthcare professionals and interested organizations are important here.

Interconnectivity is another difficult but important hurdle to take. Patients can look for information and combine it but they cannot be expected to type in all the missing medical information. Therefore creating interconnectivity where patients can import and export medical information from and to other sources into their PHRs is a must. This interconnectivity is frankly rather complex as there are no platforms or standards that ties medical information systems together. The EPD initiative was trying to offer such a platform and standard but many experts see the technology as outdated and unusable. Going back to the PHR 2.0 concept as Eysenbach describes where the social element plays a vital role, interconnectivity with typical social mediums such as Twitter, Facebook or the Dutch Hyves might be an interconnectivity worthwhile exploring too.

The final point of attention is the choice of the righteous revenue model. Whether you call it E-Business, E-Health, Social Media or whatever term applies the product best, there still needs to be a source of revenues. There are many revenue models in existence today that can also be applicable on Personal Health Records. They all have their strengths and weaknesses as chapter 6 also showed, however a few conclusions can be made.

Advertisement models seem less favorable as the margin is not high and the page views per patient shall not be as much as e.g. the search page of Google or the pages on Hyves. It is unrealistic to anticipate that people check their PHR daily and watch a lot of pages, the usage frequency will be heavily correlated with whether or not going thru a treatment. A subscription model might work better as it is not usage dependant, but, the service needs to be partially free so patients can try-before-buy and the barrier to use it is lower. However, the best option would still be discovering how much financial benefits the usage of a PHR can bring to hospitals, health insurance companies and see if these organizations like to invest money to obtain these benefits. In order to do this, more insight into the business models of these organizations is needed to explore these benefits.

This research presented an initial business model for Personal Health Records, offering several business opportunities to the management of Pink Roccade Healthcare. A different company might choose other options from this business model, depending on their business plans. In the future it will be possible to evaluate with choices work(ed) better than others.

### 7.3 Reflection

When this research began in October 2008 at first the idea was to write the ideal business model for exploiting Personal Health Records on the Dutch healthcare market, however, during the research it became more and more clear that there is no exact ideal business model as there were too many variables based on choices, preferences and uncertainties in the market to give a one-way answer. As the Blue Ocean strategy already explains the market is very novel and the opportunities for Personal Health Records are still very open. We can also see this in practice in the different Personal Health Record products that are in existence today. This business model projects the opportunities that are available; it is up to the characteristics and choices of the company to decide which opportunities they favour above others. For instance Lifesensor uses a totally different revenue generation logic than Google Health as their management simply has different strategic views.

In order to inform the management of Pink Roccade Healthcare thoroughly, this research then focused more on describing a holistic view on all the business logic required for exploiting a Personal Health Record in the Dutch healthcare market and which options and opportunities are there to be taken into consideration. Bouwman (7) refers to these options as Critical Design Issues. These are building stones that form the value creation logic around a certain product, using the Osterwalder business model to classify and arrange these Critical Design Issues.

As Personal Health Records are a new phenomenon in healthcare, the research into these applications is not much evolved either. In fact, the majority of the research on Personal Health Records is descriptive about what they are and what they can mean for the healthcare system, but research into the business side of things regarding Personal Health Records could not be found. The interest in Personal Health Records is growing, so more companies are looking into the possibilities of offering one, so hopefully in the near future more research, besides this report, shall be done into this area of business modeling.

When the business model was presented to experts internally, it became clear that they found it valuable as they might have known one part of the model but now it allowed them to see the total picture. So readers will find parts they recognize and parts that are new and informative as well.

The business model presented in this research is a good basis for other E-health/Medicine 2.0 initiatives to get ideas from. It is an example how the generic business model and its building blocks described by Osterwalder (36) can be used to form a business model specific for E-health and in this case Personal Health Records. It can also be an alternative approach to Bouwman (7) his business model that describes how business can be modeled specifically for services, with the slight difference that in this Personal Health Records business model the domains - as Bouwman calls them - are more specific, especially in relation to the customer and in relation to a particularistic service approach, being E-health.

## 7.4 Further Research

As this research focused on a holistic view and had a limited timeframe, there are a lot of possibilities to deepen the research. Basically every building block of the Osterwalder business model (36) can be a topic for further research. However there are a few areas that strike as very interesting:

- During the research it became clear that the current healthcare system is structured quite complex and that finances and interests can be, or perhaps even should be, aligned better on a multi-organizational level. So the focus needs not be on one actor in the healthcare network specifically but should be looking at a network of actors, sometimes referred to as disease management or care chain/network. So, whereas this research only looked from the perspective of a vendor of E-Health applications, research with a more extrospective focus, looking at how multiple and versatile healthcare organizations can all cooperate together - perhaps by connecting their business models with one other - might be very beneficial for the healthcare system.
- A lot of literature that was used in this research was based on the American or Canadian healthcare system, which has significant differences to the Dutch system. So a good topic for future research would be finding more facts and literature that reflect the Dutch healthcare system specifically as this will improve the validity of certain generalizations.
- More market research is needed to really specify a product design, which can be the next step after setting up a business model. Obviously doing a product design was beyond the scope of this paper; however it is a vital step when inventing new products. The market needs to be understood and how the product can exactly facilitate the needs and requirements that potential users have.
- Research into the organizational structure and costs needs more attention. There is a foreseen issue that firms that follow the Web 2.0 philosophy need to be lean and mean, however, existing firms (that existed before Web 2.0) already carry a certain hierarchy with them and are often organized in a different manner than Web 2.0 prescribes. Depending on the revenue generation model that the company picks, this organizational structure and its corresponding costs can become quite vital, especially when a company chooses for the advertisement model. As this research offered too many choices in opportunities, financial projections of costs and revenues were excluded from the research, this was also beyond the scope. Interesting might be to find out if following the Web 2.0 philosophy is actually possible for healthcare businesses and if so, how exactly?

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## Internal documents

Business Plan Healthcare 2008; MHO Documentatie; Market Research at Hospitals



## Appendix I: List of Abbreviations

IT	Information Technology
PHR(s)	Personal Health Record(s)
Blogs	Slang form of “Web logs”
EU	European Union
LINH	Landelijk Informatie Netwerk Huisartsen (translated: National Information Network General Practitioners)
PHS	Personal Health System
EHR(s)	Electronic Health Record(s)
EMR(s)	Electronic Medical Record(s)
RSS	Really Simple Syndication (RSS2.0)
EPD	Electronisch Patientendossier (translated: Electronic Patients Record)
NPCF	Nederlandse Patienten Consumenten Federatie (translated: Dutch Patients Consumers Federation)

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