Utrecht University
Science and Innovation Management
Master Thesis
9th July 2013

Disruptive Innovations in the Dutch Healthcare Sector

What Works with and Against Them?

A Case Study of Diffusion of Disruptive Innovations in the Dutch Healthcare Sector and how this Process can be improved

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Abstract

Through a comparative case study, this research aimed to identify the stimulating and thwarting factors for the adoption of disruptive innovations in the Dutch healthcare sector. Disruptive innovations are the opposite of sustaining innovations. They are applications of existing technology, but in a cheaper and simpler form, aiming for the lower demanding customers or complete new markets. Thereby, the products could suffice for a large share of the procedures in healthcare operations and thereby potentially increasing efficiency of the entire system. Disruptive innovations are however not adopted by the Dutch healthcare sector as often as one would hope. The main research question is therefore:

How can the diffusion process of disruptive innovations be improved in the Dutch healthcare sector?

By answering this question, insight in the empirical applicability of innovation theories in the healthcare sector could be obtained, but also the potential tools to make the healthcare sector more efficient and hence lower the social costs.

Seven successful and six unsuccessful cases were selected in two different technology areas: medical technology and ICT. Due to the complexity of the Dutch healthcare system, besides Rogers' adoption indicators for the diffusion of innovation, these cases were analysed by using context indicators as well.

Comparison of adoption factors showed that the 'evidence required by users' and 'positive experts' opinions' are of importance for successful diffusion. In the ICT technology field, also the 'absorptive capacity of users' can form an obstacle for the diffusion of an innovation. Nonetheless, most of the cases showed good performance on all other adoption indicators, proving the significance of the context in the innovation process.

From the context analysis, the relevant actors and twenty specific factors that are of importance for adoption of innovations were identified. The key actors are the medical professionals and, to somewhat lesser extent, the patients both as users of the innovations, and second, the CVZ and healthcare insurers respectively approving and providing financial compensation for innovations. By considering the twenty factors against all the cases, the 'knowledge of regulations' and the 'adherence to the rules of conduct' seem to be of importance for the successful adoption of a disruptive innovation as well. Additionally, in the ICT technology field, an insufficient amount of (financial) resources, dependence on policy changes, technology push development, and dependence on subsidies or other financial support are all potentially thwarting for the diffusion of a disruptive innovation.

All in all, the diffusion process of disruptive innovations can be improved when for one, producers of disruptive innovations meet the relevant adoption and context indicators, but besides that, an increased focus on the efficiency of an innovation instead of on quality or efficacy would lead to more approvals for disruptive innovations and less 'decision power' with the same group of people (medical professionals) would result in more differentiation of innovations.

Table of Contents

1. Introduction

1.1 Background: The Dutch Healthcare System

The expenses in the Dutch healthcare sector are rising and taking a bigger share of the GDP every year. They have grown from below 6% of national GDP in 1972 to almost 15.4% in 2012, adding up to a total of more than 92 billion EUR (OECD, 2012; CBS, 2013). Future scenarios show a prediction of a 19% share in 2040 in the best case, and 31% in the worst-case (Van der Horst et al., 2011). One of the reasons for this process is the increase in chronically ill people. People are living longer, and older people have a higher chance on developing a chronic disease. Also, and probably because of the latter, the demand for healthcare increases with age (CBS, 2009; CBS 2011; Wong et al., 2008). Due to the general aging process in the western world, there are relatively more elderly people, causing the number of patients with a chronic illness to rise (Planbureau voor de Leefomgeving, 2012).

On top of the demographic changes, the incremental advancements in healthcare technologies cause the costs per treatment to rise. More and more advanced technologies are used to improve existing treatments, diagnosis and the overall processes, and cure and treat new diseases. They are however not replacing, but often additional to existing technologies, and thereby continuously adding to the total costs (Van der Horst et al., 2011). Moreover, due to the complexity and rigidity of the sector, it takes averagely sixteen years before a new method is standardized, making the innovation process slower than comparable sectors (Voermans, 2012). Altogether, this leads to an unceasing increase of relative spending on healthcare within The Netherlands.

To counter these current trends, innovations that make the sector more efficient are one of the options that have been suggested. A solution given by Christensen et al. (2000), for instance, is that of disruptive innovations. These are applications of technology that already exists, but in a cheaper and simpler form, aiming for the lower demanding customers. The products should however suffice for a large share of the procedures in healthcare operations and thereby lower the costs. Examples of disruptive innovations in the healthcare sector are home pregnancy tests, miniature blood glucose meters, and angioplasty (Christensen et al., 2000; Hwang and Christensen, 2008; Cowan, 2007). The first two made large laboratory testers superfluous and less attention from physicians was necessary. Patients found these methods more accessible and more convenient in usage. Angioplasty made it possible for less specialized and expensive practitioners to treat more patients causing less pain and disability. They started this new treatment in the 1980s with only the simplest cases, and over time it became a common supplant to complex bypass surgery (Christensen, 2000). It is therefore assumed that when adopting more disruptive innovations in existing healthcare practice, the expenses will be lower eventually improving the efficiency of the sector (Christensen et al., 2000; Christensen et al., 2009; Hwang and Christensen, 2008; Cowan, 2007).

1.2 Problem Description and Research Questions

These simpler, disruptive innovations are however not adopted by the healthcare sectors as often as one would hope. The complexity of a general healthcare sector – caused by the complicated legislative and financing models – with many elements that need to change to adopt an innovation, makes it hard for some products to find their way. These elements are for example "*regulators, afraid of putting patients at risk and would therefore withhold approval; medical specialists, who establish the licensing that regulators enforce, do not want to lose their jobs, so they would fight it; Insurance companies, which approve only established licensed procedures, would refuse to reimburse for it; and hospitals, with their large investments in existing technologies, want to exploit them, and*

thereby joining forces holding back change" (Christensen et al., 2000, p.1; Fitzgerald et al., 2002; Van de Ven et al., 1999; Ferraro, 1993).

One example of an unsuccessful, disruptive innovation is the 'Customized Eyeglasses Machine' that makes customers able to create personal eyeglasses for less than €5. Another is a portable, low-intensity X-Ray machine that can create images for 10% of the costs of conventional machines in the office of a GP or nurse practitioner. Even with the promising prospects, existing professionals, hospitals, insurers, etc. prevented the implementation of these applications, probably, to protect their own investments and interests (Christensen et al., 2000; Hwang and Christensen, 2008). Nonetheless, most research on disruptive innovations in healthcare has been done in the U.S. Healthcare systems are often organized at national or regional level, with many differences in between them.

For this study, we accept the idea that disruptive innovations indeed improve the efficiency of a sector. We did however want to find out how the adoption and thereby the diffusion of these disruptive innovations can be stimulated in The Netherlands. Therefore, a better understanding of the mechanisms surrounding the adoption of a disruptive technology in this system deeded to be obtained. Herein, the influence of different actors in the Dutch healthcare sector is the main indicator of adoption (Fitzgerald et al., 2002). This study investigates the enhancing and disturbing indicators for adoption of several successful and unsuccessful cases and possible policy actions to enhance that process. The research question is thus:

How can the diffusion process of disruptive innovations be improved in the Dutch healthcare sector?

To answer this, the involved formal and informal processes that take place in adopting an innovation in the healthcare sector (Fitzgerald et al., 2002) should be investigated. A comparison between successful and unsuccessful adoptions herein should enable identification of the crucial factors in this innovation process. The type of technology also was taken into account; therefore, identification of differences between technology areas is also described. The following sub-questions guided the study. Elaboration on these is given in the 'Methodology' section.

SQ 1. *What are the relevant actors in the Dutch healthcare sector per type of technology and how are they related?*
SQ 2. *What are examples of successful and unsuccessful disruptive innovations in the Dutch healthcare sector?*
SQ 3. *What are the stimulating and thwarting factors for the adoption of the disruptive innovations in de the Dutch healthcare sector per technology type?*
SQ 4. *How can these findings change policy to stimulate the development and implementation of potential disruptive innovations?*

1.3 Theory

One way to study the adoption of innovations is by using Rogers' model of diffusion of innovation (1983). This is the main theory to investigate the qualities of a product and how these qualities influence the adoption by consumers. Hereby he evaluates the relative advantage, compatibility, complexity, triability, and observability of a product. Indicators specifically to these factors can give insights in the 'adoptability' of an innovation.

The healthcare sector is however more complex, given the many actors involved that determine the adoption, the dynamic character of both product and actors over time and the underlying (financial) interdependencies between actors (Christensen, 2000; Fitzgerald et al., 2002; Wejnert, 2002). Reviews on adoption of innovation state therefore that in the theory of Rogers the importance of context is neglected

(Fitzgerald et al., 2002; Wejnert, 2002). A broad spectrum of indicators for politics, culture, and networks in context was abstracted from these theories to enable measurement of those factors as well.

To combine and categorize the internal qualities of a technology – as defined by Rogers – and the external influences – in context indicators –, the regime pillars of the Multi Level Perspective (MLP) approach are used as described by Geels (2002). The MLP stresses the dynamic and multi-layered character of the innovation process. It generally describes how long-term, multi-actor system changes, so-called 'transitions', occur. While this research aim is more modest, the way Geels depicts *context* and *dynamics* is seen as a useful addition to the approach of Rogers. In here, the innovation needs to survive in the context, which is described by 7 pillars of the regime. MLP handles the *dynamics* by emphasizing on the interplay between innovations and the conservative forces of incumbent actors. Hence, MLP offers the dimensions that show the complete range of possible influential factors that determine the successful adoption of an innovation (visualized in the conceptual framework).

1.4 Research Method

A literature study combined with expert interviews and a case study analysis was used for this research. Case studies are holistic of nature and can explore the formal and informal processes accompanying innovations in healthcare. Thereby, the case studies provided profound insights in the innovation process. The first part of this research consisted of a description of the actors, underlying relations and potential influence they have on the diffusion of an innovation; in other words, the MLP of the sector. This was achieved by literature research, information from an internship at BeBright, and interviews with experts. These experts each covered the general MLP of the Dutch healthcare sector, or the MLP specifically in one technology area. BeBright has defined four technology areas (medical technologies, e-health/ICT, pharmaceutical technologies and nutritech). Each of these areas have a separate set of actors and relations, therefore, a separate MLP per area is convenient. For this study, the first three technology areas were further investigated. Next, fifteen cases of disruptive technologies were selected. They were studied via a short survey on the adoption factors as described by Rogers (1983). A comparison of successful and unsuccessful cases gave insight in the stimulating and thwarting factors for the adoption of disruptive innovations in the Dutch Healthcare sector. Finally, the linkage between the adoption and context indicators gives an idea on the crucial points for the diffusion of a disruptive innovation in the Dutch healthcare sector. A more elaborate description of the methods, explaining research design and data collection and analysis is given in chapter 3.

1.5 Scope

This study focuses upon innovative technologies in the healthcare sector in The Netherlands, because, as was explained above, this sector faces some major challenges in the near future. These challenges are the increasing costs and number of people with diseases combined with less financial means to cover the increases (OECD, 2012; Van der Horst et al., 2011; Ministry of VWS, 2007; Planbureau voor de Leefomgeving, 2012; CBS, 2011; Wong et al., 2008; CBS, 2009). The Netherlands has an enclosed healthcare sector regulated by the government, which made it possible to identify the actors and influential indicators within this system (Fitzgerald et al., 2002; Idenburg and Van Schaik, 2012). The types of technologies all have a disruptive nature. They should be able to change the existing system into a more efficient and high-quality market.

1.6 Relevance (scientific and social)

In the light of Science and Innovation Management, this study provided a better insight in the empirical applicability of innovation theories in the healthcare sector. It also showed elaborate information on the potential of disruptive innovations in the Dutch healthcare sector and the changes

that need to be made in order to stimulate more of these specific technological innovations to lighten the burden of healthcare costs on a society.

Subsequently, from a social perspective, this study party offers answers and ideas on how to improve the healthcare system, which has a great significance after fully grasping the impact of increasing healthcare costs in the future. Improved efficiency of the healthcare system will benefit society on a whole, and research toward potential methods to realise that goal is hence relevant.

1.7 Outline of Report

This report will continue with the theoretical framework that substantiates the conceptual model of this research in chapter 2. To select relevant cases, a more elaborate description of disruptive technologies is also given in the second chapter. A description for the methods on research design, operationalization of the theory, case selection, data collection, and data analysis is given in chapter 3. Chapter 4 describes the results, implications, and first answers on the research questions. Chapter 5, 6, and 7 consist of respectively the conclusions, discussions, and references. Finally, the appendices show all the additional information concerned with this research.

2. Theoretical Framework

This study started with the idea that disruptive innovations are able to make the Dutch healthcare sector more efficient. However, what are disruptive innovations exactly? In addition, how does diffusion of innovations take place? This is explained in the first part of the theoretical section.

2.1 Disruptive Innovations

Generally, the theory of disruptive innovations is based on technologies that target the lower-end of the market. Customers with fewer expectations and lower demands characterize the lower-end of the market. As is visualized in figure 1, disruptive innovations are the counterpart of sustaining innovations. Sustaining innovations are characterized by continuous technical improvement and specialization to meet the demands of the high-end customer. However, at a certain point,

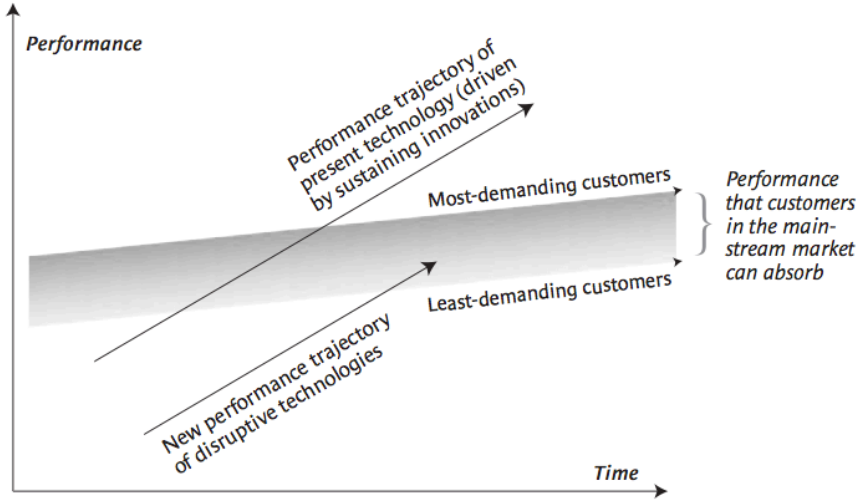


Figure 1: The Progress of Disruptive Innovation
(Christensen et al., 2000)

the possibilities and performance of products or services overshoot the actual demand of all customers, making the product or service more expensive than necessary, due to investments in technological advancement. At this point, when a disruptive technology is introduced, it often can meet the demands of a large share of the customers, even though it uses less advanced technology. Due to the latter, the product is often simpler, cheaper and more convenient in usage. This process is of course not beneficial for the, formerly dominant, producer of sustaining innovations (Christensen et al., 2000; Christensen et al., 2009).

The term 'disruptive innovation' is often confused with a 'radical innovation'. To be clearer on this topic, the three main characteristics that Christensen describes in his books and articles on disruptive innovations are more elaborately explained. Starting with the first period after implementation, a disruptive innovation initially provides inferior performance compared to existing products available in that industry. It is therefore often not seen as a threat or potential replacement by existing market actors and users. The second outcome of these types of innovations is that they serve markets that did not exist before. Besides the lower-demanding users, these customers can, for instance, be people that did not know they were able to use these products or technology. Consequently, existing producers are regularly not that interested in disruptive innovations, as they do not serve their existing customers. Thirdly, disruptive innovations tend to have a very steep improvement trajectory over time. Hence, they are able to meet the demands of the initial market as well. The latter is however not as important as the first two (Christensen et al., 2009; Krishnan, 2012).

Disruptive innovations can occur in any industry or social sector. Some examples are personal computers, table copiers, low-cost airlines, micro-finance, and online education. All did not do something new, but made the same technology available for new markets. The differentiation between sustaining innovations and disruptive innovations is thus based

on performance and market-related parameters. This is different from radical innovations that are compared to incremental innovations based on the level by which they improve performance or change a technology. A radical innovation requires new knowledge and resources and changes the performance of an industry. They solve problems that the specific industry was up to that point not able to solve and are in that sense very rare (Krishnan, 2012).

The 'disruptiveness' of a disruptive innovation lies accordingly in the social changes that are the effect of the diffusion. In the healthcare sector, Christensen et al. (2000) have described how disruptive innovations can take two forms. The first of which is 'The disruption of healthcare institutions' (figure 2). In this process, the tasks of institutions are optimized to their abilities. For example, in this scenario would academic hospitals only focus on the most complicated and severe diseases or patients, and leave those less severe cases to specialized care-centres, outpatient clinics, or general practitioners (GPs).

Another scenario describes 'the disruption of healthcare professions' (figure 3) in which specialists focus their time only on the area of their expertise and leave less complicated cases for less-skilled practitioners. Especially nurse practitioners can handle more patients than they are currently allowed to do. However, just as 'regular' innovations, disruptive innovations face similar factors during the diffusion process.

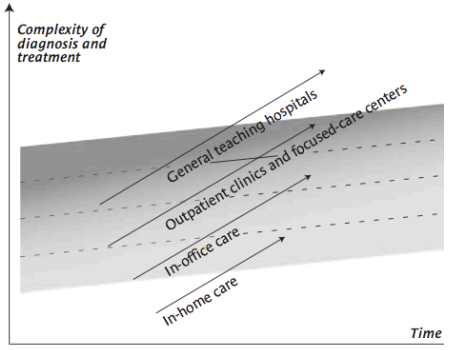


Figure 2: Disruption of Healthcare Institutions
(Christensen, 2000)

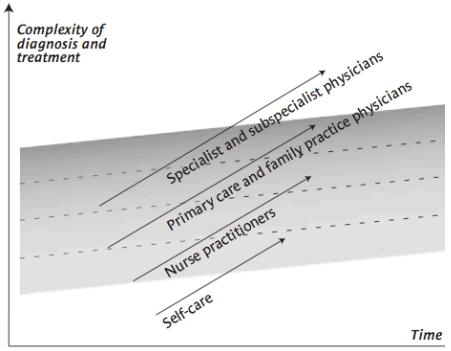


Figure 3: Disruptions of Healthcare Professions
(Christensen, 2000)

2.2 Diffusion of Disruptive Innovations

The diffusion of innovations is a prerequisite to changes in any sector. As Rogers defined in 1995, "*diffusion of innovations refers to the spread of abstract ideas and concepts, technical information and actual practices within a system, (…) by the flow or movement from source to an adopter*" (in Wejnert, 2002, p. 297). In this theory, Rogers defines five factors that help determine the quality of a product and how these qualities influence the adoption by consumers. These indicators are 'relative advantage', 'compatibility', 'complexity', 'triability', and 'observability'. They set the conditions under which a consumer decides to adopt or not.

As concluded from the earlier chapter, disruptive innovations are able to change sectors as soon as they are adopted and diffused through a system. Fitzgerald et al. (2002) reviewed that to describe the diffusion of innovations in the healthcare sector, one needs more than an approach with that single adoption decision of consumers. Adoption of innovation is often a prolonged and negotiated process between individuals and groups (Fitzgerald et al., 2002; Van de Ven et al., 1999). From empirical evidence, they have proven that scientific or technological proof alone is not enough to ensure adoption in the healthcare sector. The influence of active actors and differing contexts also needs to be considered. For instance, from earlier research on diffusion of innovation has been concluded that the influence of networks is the most important (Swan and Newel, 1995; Chaves, 1996; DiMaggio and Powell, 1983; Davis, 1991; all in Wejnert, 2002).

In the healthcare sector, there are multiple actors involved, and the multi-layered context in which political influences, networks and cultural values can be measured is accordingly of great importance (Fitzgerald et al., 2002; Rich, 1997; Wejnert, 2002; Coleman et al., 1957). As was described in the introduction, the theoretical framework of this study uses the multi-level perspective approach (Geels, 2002) to describe this dynamic and multi-layered environment in which these disruptive healthcare innovations are adopted. The way Geels depicts *context* and *dynamics* is seen as a useful addition for this study. It will help to distinguish differences in, for example, political and legislative environment for different types of technologies. In addition, a general overview of the relevant actors of the market helps to understand the forces that have an influence on the innovative process of disruptive innovations. Indicators that are determining whether a technology is finally adopted will be subtracted from here on with a basis in the diffusion theories of Rogers (1983; Fitzgerald et al., 2002; Wejnert, 2002). So, next the use of the MLP in this is described.

2.3 Multi-Level Perspective

Generally, the Multi-Level Perspective (MLP) approach is used to describe Technological Transitions (TTs). A TT changes the user practise, regulations, infrastructure, and networks specific to the existing environment of a certain technology (Geels, 2002). In this study, disruptive innovations are unlikely to cause an entire TT. The use of the MLP is therefore limited to the description of the existing system and the categorization of influential factors. It helps categorizing the context in a manageable way.

The MLP consists of three levels: (1) 'Socio-technical Landscape' (macro-level), (2) 'Socio-technical Regimes' (meso-level), and (3) 'Technological Niches' (micro-level). With a TT, a new technology starts at the micro-level and slowly emerges to the meso-level to become the new standard in the sector while interacting with all (conservative) actors (see figure 3).

1. The socio-technical landscape is defined as a set of deep structured trends. These are for example material and spatial arrangements of cities, Hospitals, universities, highways, economic growth, broad political coalitions, cultural and normal values factories, highways, and electricity infrastructures, but also heterogeneous factors such as oil prices, economic growth, wars, emigration, broad political coalitions, cultural and normal values, and environmental problems. The landscape sets the external structure or context for interactions of actors in any sector and is very hard to change. When it changes however, it changes very slowly and indirectly.
2. The socio-technical regime refers to rules of an existing standard based on the 'common sense' of the actors in a field. These shared rules form a regime that enables and constrains activities within the healthcare sector and limits the adoption of disruptive innovations. The main pillars (dimensions) are technology, application domains (markets), culture (symbolic meaning of technology), infrastructure, industrial networks (of suppliers, producers and distributors), sectoral policy, and scientific knowledge. Within these dimensions, technological trajectories form a stable direction of technical development of the existing standard.
3. The technological niches represent 'protected' spaces in which, for instance, disruptive innovations are tested on a small scale. In this environment, they can be perfected before they enter the 'tough' market selection. One form that exists is the technological niche in which the regular market conditions do not have an influential role because of special conditions created through subsidies and alignments between multiple actors. The second form is the market niche in which regular market transactions prevail. Generally, the rules within a niche are more variable, broader, and more diffused as opposed to the rules in regimes; guidelines and visions guide the

activities. Additionally, the social networks are significantly smaller and more precarious. These networks can grow stronger and bigger over time, providing a stronger social constituency behind a new technology.

The relation between these three levels is visualized in figure 4. In here, new technologies emerge from the variable niches. This process is established by aligning the network surrounding a new technology. In the background, the existing regime and landscape continue along their trajectories. Failure of new technologies is often explained by misalignment with the existing regimes, or strategic opposition from existing actors in the sector. However, when linkages in the existing

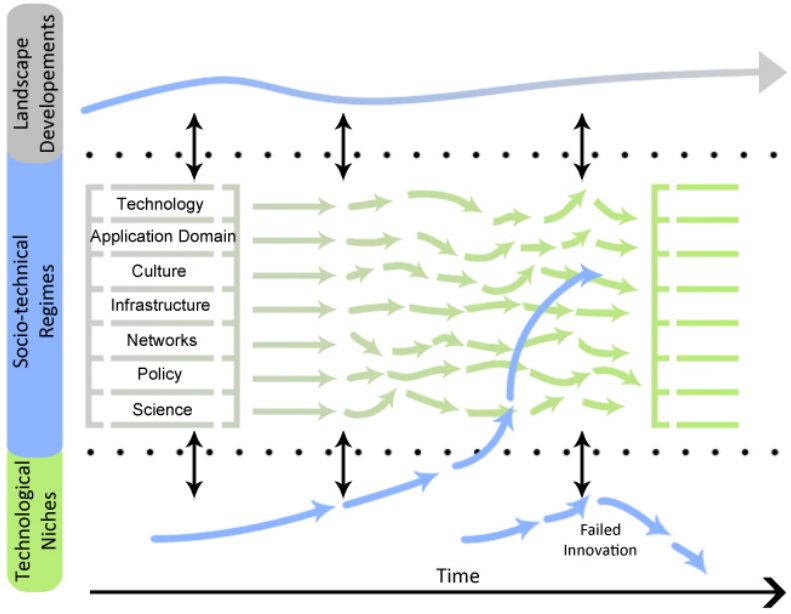


Figure 4: A Dynamic Multi-level Perspective on Technological Transitions
(Based on Geels, 2002)

trajectory loosen up, an opportunity for innovations to be incorporated forms itself. Innovations break out of their niches when they can link up with processes at the regime- and landscape-level. In the case of disruptive innovations, they too have to find their way through the MLP and align with the regime processes. In the MLP, the introduction of new technologies may trigger further shifts, sometimes even changing the whole socio-technical regime. In the end, a technological transition takes place because changes in many elements accumulate, link up and reinforce each other. The reconfigurations resulting in a transition does not occur easily due to lack of alignment and linkage among the different elements. Also, in the healthcare sector, established technologies will not be replaced easily by alternatives, when this involves changes in other elements.

During this study, the definitions of the seven pillars of the healthcare sector are:

- **Application Domain** consists of the users of technology. These can be patients, medical professionals, carers, or healthcare institutions.
- **Technology** is defined by the existing technology standards that are available.
- **Culture** describes the general morals and values in the healthcare sector, but also the expected healthcare standards, economic welfare, and relational factors between caregivers and patients.
- **Infrastructure** describes the existing hospitals, care centres, and educational facilities.
- **Networks** are defined by the underlying relationships between relevant actors. These are of course the consumers and producers, but also health insurers, patient advocacies, umbrella organizations, government institutions, medical institutes, and research institutes.
- **Policy** consists of the rules and regulations surrounding the healthcare sector. Important institutions and influential actors define this pillar.
- **Scientific knowledge** is defined by the general knowledge and education level of users, but also by the availability of new knowledge.

The pillars substantiate the research to disruptive innovations because they help forming the external adoption indicators of the conceptual model later on in this chapter.

2.4 Type of Technology

The type of technology is also relevant for the MLP, because regulations, culture, relevant actors, etc. can differ per technology sector. From previous research to technologies in the healthcare sector, BeBright has selected four technology fields that have different origins and implementation processes (see table 1). These technology areas are assumed to have different required adoption factors and actors in their networks and are assumed to have a different MLP. In the first phase of the research, the MLP for each relevant technology area will be formulated based on literature research and interviews with experts in each field on top of the general description of the Dutch Healthcare sector (BeBright, 2013).

Table 1: Technology Areas in Dutch Healthcare

Medical Technologies		These types of innovations cover all equipment, instruments, implants, in vitro diagnostics, and appliances/machines/devices of physical inorganic character.
E-Health/ICT		All information and communication technologies of non-material character to improve individuals' health, but also the processes in the healthcare sector.
Pharma	 Biotech	All technologies of organic character such as bioprocesses and living organisms as well as their parts. Technologies that are used to develop new substances, processes, and products of medical/non-food character.
	 Chemical tech	All technologies of chemical character, such as applied pharmacy and pharmacology, used for the manufacturing and preparation of drugs and other substances of non-biological origin.
Nutritech		All technologies involved in the production or development of the high quality nutritional food, functional food, food supplements and personalized nutrition.

2.5 Theoretical Indicators of Adoption

Rogers (1983), Wejnert (2002) and Fitzgerald et al. (2002) describe several indicators of diffusion and adoption of innovations in general. Fitzgerald et al. (2002) focus their research and indicators specifically on the healthcare sector. In other words, which factors have proven in de past that they influence the adoption of innovations in healthcare sectors? The relevant indicators for this study are assigned to the seven pillars from the MLP and Rogers' adoption factors. The complete table with indicators and their explanation directly subtracted from these articles is given in appendix A. In the process, the adoption indicators were based on performance of the innovation itself (relative advantage, compatibility, complexity, triability and observability), and the performance during preparation (technological niche activities). The technological niche activities are defined as the behaviour and actions from the producers. Producers can be either large firms or small developers of technology, more or less any entity that introduces a product in the market. By conducting certain actions, they can positively stimulate adoption. On the other hand, there are the context factors (political, cultural and networks) that also have an influence on the acceptance of an innovation and are related to the pillars of the MLP (Abelson, 2001).

Together, these theoretical dimensions and their indicators lead to the conceptual model, in which they either positively or negatively influence the implementation process of disruptive innovations. Indicators used to operationalize the research are selected from the theory and given in table 2 in the next chapter (3.2 Operationalization). These indicators form the basis of the interview questions and surveys.

2.6 Conceptual model

The basic idea of this research is that the diffusion of disruptive innovations in healthcare cannot solely be explained by Roger's adoption factors, and will depend on other, contextual factors as well. The indicators from the regime level of the healthcare system accordingly interact with a disruptive innovation and its adoption factors and vice versa. The adoption factors, as descripted by Rogers, will eventually determine whether the diffusion of a disruptive innovation takes place. As was said before, it is assumed that the diffusion of a disruptive innovation will lead to a decrease in healthcare costs, or at least in higher efficiency. Each of these dimensions can have either positive or negative influence, ultimately determining the adoption of an innovation. Each negative influence from any dimension makes the diffusion process harder (Fitzgerald, 2002). In the operationalization in chapter 3.2, the dimensions will be further elaborated on and indicators of these will be formulated.

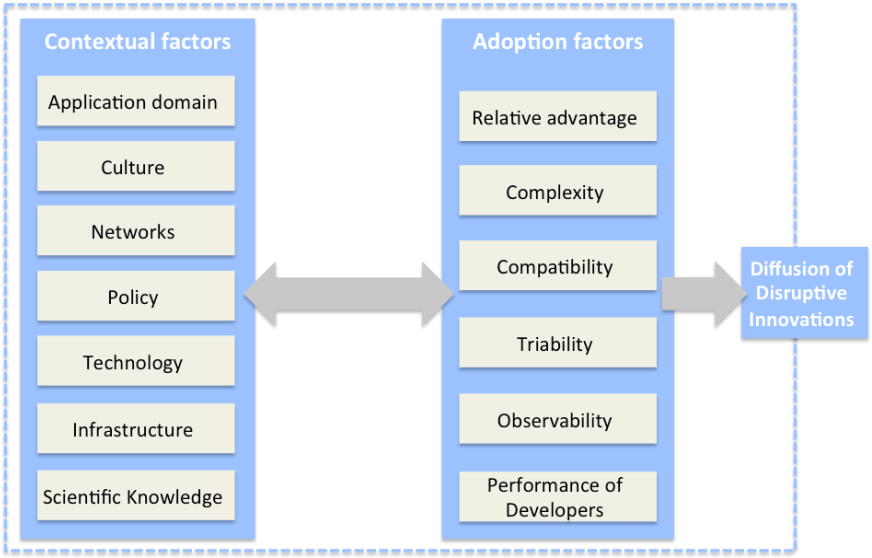


Figure 5: Conceptual Model

3. Methodology

3.1 Research design

The main research question on how the diffusion process of disruptive innovations in the Dutch healthcare sector can be improved touched upon formal and informal processes within a larger system. To examine the views of a multiple actors, a case study analysis was considered to the best option. Case studies are holistic of nature and can explore these formal and informal indicators, which occur in the healthcare sector (Fitzgerald et al., 2002). By comparing a minimum of two successful and two unsuccessful cases on their performance on preselected adoption indicators and per technology area, profound insights in the diffusion of these innovations could be obtained. These indicators were based on the theoretical framework and visible in the 'operationalization'. So, multiple cases were selected and analysed based on the Adoption Indicators. However, as was stated in the theory, the context should also be considered. The dynamic character of the healthcare sector can be of influence of the diffusion of innovations. MLP handles those dynamics by emphasizing on the interplay between innovations and the conservative forces of incumbent actors. Hence, MLP offers the indicators that show the complete range of possible influential factors that determine the successful adoption of an innovation (these indicators are also described in the operationalization). From that analysis, a set of significant factors were abstracted that could again be compared to the selected cases of disruptive innovations. Finally, an answer to the main research question could be formulated by drawing conclusions from the significant differences between the successful and unsuccessful cases. This means that when the successful cases perform significantly 'better' (or different) on a specific indicator (either context or adoption factor) than the unsuccessful cases, it could be concluded that the specific indicator is of significant importance for successful adoption. Additionally, information on the context of the Dutch healthcare sector could also provide more information on thwarting factors for the adoption of disruptive innovations. To guide the research and collect the required data, a set of sub-questions had been prepared based on the main research question:

SQ 1. *What are the relevant actors in the Dutch healthcare sector per type of technology and how are they related?*

Via a continuous literature study, the collection of existing data available at BeBright and semi-structured, in-depth interviews with experts in the field, an overview of the general healthcare sector is given, as well as an overview per technology area (medical technologies, e-health/ICT, and pharmaceutical technologies). These experts were for example a representative of GlaxoSmithKline (GSK) for the pharmaceutical industry, a representative of Philips for Medical technologies, and an employee of KPN for e-health/ICT technologies (see appendix B). The structured part of the interview was based on the operationalization for 'context factors' and provided both qualitative and quantitative data. Subsequently, these results were categorized according to the MLP regime pillars. The underlying relations between actors and their specific objectives and interests gave insight in the complexity of the system. This knowledge helped to unravel the multifaceted factors that play a role in accepting a new technology or not, and the level of influence they are able to exert on the outcome.

SQ 2. *What are examples of successful and unsuccessful disruptive innovations in the Dutch healthcare sector?*

From literature research to the nature of disruptive innovations as described by Christensen and partly done in this proposal, a clear formulated definition defined the framework to select (potential) disruptive innovations in different technology areas. Preferably,

per technology area, there were successfully and unsuccessfully implemented cases. Of course, during this process it was considered that the definition of successful diffusion can vary over time and the perspective on the level of and necessary numbers for adoption can change. More on this is described in the section 'case study selection'.

SQ 3. *What are the stimulating and thwarting factors for the adoption of the disruptive innovations in de the Dutch healthcare sector per type of technology?*

Partly from the semi-structured interviews with field experts and partly from small surveys with producers, it became clear which interacting indicators have a positive or negative influence on the successful implementation of disruptive innovations. These surveys were based on the indicators for 'performance of innovation and producer' as described in the operationalization. In addition, the relations and conformation with the context factors were tested. In the results tables 8, 9 and 10 (see chapter 4), the data analysis of this interaction between indicators will be summarized. The dimensions from the regime level of the healthcare system interact with a disruptive innovation and its competitive adoption factors and vice versa. The subsequent comparison between the successful and unsuccessful cases gave insight in the differences of significant indicators for the success of diffusion.

SQ 4. *How can these findings change policy to stimulate the development and implementation of potential disruptive innovations?*

In the final phase of this master thesis, the prospective is to define the bottlenecks and the possible solutions for the improvement of diffusion of disruptive technologies in the future. In the interviews, a part was dedicated to see what ideas the experts have. Also, the analysis of successful and unsuccessful cases of disruptive innovations was expected to display the differences in approach and realization.

3.2 Operationalization

In this section, the indicators abstracted from the theoretical framework and the conceptual model (figure 5) are transformed into a pragmatic representation in table 2. The complete table with indicators and their explanation directly subtracted from the theory is given in appendix A.

This operationalization makes it possible to structure the interviews and data analysis. At measurement level, the lowest score in the Likert scale means the least feasible conditions for the introduction of new products or technologies in that MLP or the least feasible qualities of the innovation to introduce it in this sector.

In the end and based on the conceptual model, the 'fit' of the internal adoption indicators to the context indicators will show the success factors of different disruptive innovations.

Table 2: Operationalization

Performance of innovation and producer			
Dimension	**Main Indicator**	**Measurable Indicator**	**Measurement**
Adoption factors	Relative advantage	Performance in quality	Bad – worse – same – better – good
		User friendliness	Bad – worse – same – better – good
		Time for implementation	Much longer – longer – same – shorter – much shorter
		Scope of illness	Very low – low – average – high – very high
		Severity of illness	Not at all – minor – chronic – very severe – deadly
		Adverse outcome if not used	Not at all – minor – chronic – very severe – deadly
	Compatibility	Capital required	Much higher – higher – average – lower – much lower
		Time required	Much higher – higher – average – shorter – much shorter
		Extend of management change	Complete change –A lot of change – average change – Little change – Not at all
		New tacit knowledge development	Very much – much – average – a little – none at all
		Number of adjustments necessary	Much higher – higher – average – lower – much lower
		Fits type of evidence required by users	Not at all – worse – average – better – very good
		Conflict with social or cultural morals	Very high – high – average – low – none at all
		Fits in existing network structure	Not at all – not good – average – good – very good
		Social costs	Very high – high – average – low – very low
		Possibility for standardization	Not at all – little – average – good – very good
	Complexity	Absorptive capacity of users (education level)	Very low – low – average – high – very high
		Change capacity of users	Very low – low – average – high – very high
		Type of evidence appropriate to the complexity	Not at all – not good – average – good – very good

		Number or adjustments	Much higher – higher – average – lower – much lower
		Number of involved actors	Much higher – higher – average – lower – much lower
		Easiness of mimicry	Very easy – easy – average – difficult – very difficult
		Complexity of technology fits education level	Not at all – little – average – good – very good
	Observability	Trials in similar, visible context	Not at all – little – average – some – a lot
		Media attention	Not at all – little – average – quite some – a lot
		Positive experts' opinions	Not at all – little – some – quite some – a lot
	Triability	Number of prototypes	None at all – less – average – more – a lot more
		Extend of niches or pilots	Not at all – little – some – quite some – a lot
Performance of developers	Performance of developers	Readiness for market (phase in innovation process)	Investigation phase - Development phase - Trial phase - Registration
		Use of media (popular, well-defined)	Not at all – little – average – good – very good
		Entrepreneurial talent	Not at all – little – average – good – very good
		Time spend on promotion	Much longer – longer – same – shorter – much shorter
		Fit of marketing strategy to the sector	Not at all – little – average – good – very good
Context factors			
Dimension	**Main indicator**	**Measurable indicator**	**Measurement**
Contextual factors	Application domain	Openness to new applications and technology	Not at all – little – average – relatively open – very open
		Size of patient group influence on the diffusion of innovations	Not at all – little – average – quite some – much influence
		Severity of disease influence on the diffusion of innovations	Not at all – little – average – quite some – much influence
		Is the implementation time for new technology long?	Very long – longer – average – shorter – very short
	Culture	Open to external advice	Not at all – little – average – open – very open
		The importance of status	Very important – more important – average – little – Not at all
		The importance of prestige	Very important – more important – average – little – Not at all
		Level of cultural traditions	Very high – high – average – lower – very low level
		Cultural homogeneity	Much – some homogeneity – average – divers – very divers
		Necessity for prototypes	Very important – important – average – little important – not necessary
		Necessity for pilots	Very important – important – average – little important – not necessary
	Networks	Size and complexity of networks	Very large and complex – large and complex – average – small – very small
		Strength and closeness of relations	Very close – close – average – distant – very distant
		The number of parties generally involved with implementation	Very high – high – average – few – very few
		Is it hard to meet the credentials required for acceptance?	Very hard – hard – average – easy – very easy

		Is information openly available?	Not at all – little – average – open – very open
		Is communication open	Not at all – little – average – open – very open
		The importance of authority	Very important – important – average – little important – not at all important
		Is the network density high or low?	Very high – high – average – low – very low
		Personal relations between actors at CEO level	Very personal – personal – average – distant – very distant
		Is the level of coercion high?	Very high – high – average – low – very low
		Is the innovation-related knowledge of the involved actors high?	Very low – low – average – high – very high
	Political context	Is the number of political bodies high?	Very high – high – average – low – very low
		Is the situation stable?	Very unstable – unstable – average – stable – very stable
		Is the severity of the disease of influence on policy?	Not at all – little – average – quite some – much influence
		Do polity changes take long/	Much longer – longer – average – shorter – much shorter
		Is bureaucracy an impediment factor?	Very much – quite – average – little – not at all
		Is there protection for domestic or existing technology	A lot – quite some examples – average – little – none at all
		Are subsidies going to the right place?	Never – sometimes – average – often – always
	Technology	Availability of new technology	Never – sometimes – average – often – always
		Complexity of existing technology	Very complex – complex – average – simple – very simple
		Height of existing research investments	Very high – high – average – low – very low
		Presence of uniformity or standardization in this sector	Always – very often – average – little – never
		Correct use of uniformity or standardization	Never – sometimes – average – often – always
		Appearance of imitations	Never – sometimes – average – often – always
	Infrastructure	Professional boundaries	Very strict – strict – average – easy – very easy
		Diffusion over professional boundaries	Never – sometimes – average – often – always
		Organizational boundaries	Very strict – strict – average – easy – very easy
		Diffusion over organizational boundaries	Never – sometimes – average – often – always
	Scientific knowledge	Availability of scientific knowledge	Not at all – little – average – easy – very easy
		Complexity of scientific knowledge	Very complex – complex – average – easy – very easy
		Education level of users	Very low – low – average – high – very high

3.3 Case Study Selection

The selection of cases was based on the criteria set for disruptive technologies below and in consultation with experts and internship supervisors at BeBright.

Disruptive qualities:
- Product uses existing technology and knowledge;
- It is cheaper in production and purchase (than existing technology);
- It is easier to handle than existing products and does not require existing customers to change;
- It can be used by lower-end users of the market or new users and potentially a larger group and thereby, it has a disruptive impact on organizational structure;

Besides the fact that a product must be disruptive, categorization based on success was taken into account. The number of successful and unsuccessful cases was preferably equally spread. For the level of successfulness the adoption level was used (Fitzgerald et al., 2002)

Adoption level:
- A minimum of two of the cases per technology area was successfully adopted with a widespread or variable spread diffusion.
- A minimum of two of the cases per technology area was unsuccessfully adopted by which the innovation process is either aborted or adoption is limited. The phase of the innovation process, in which this innovation was, can differ per case.

Because in the pharmaceutical and nutritional technology sectors no examples of successful or unsuccessful disruptive innovations were found, these technology areas were left out during the process. An overview of the selected cases is given in table 7, in 'Results' chapter.

3.4 Data Collection

The data obtained from literature was collected via Internet research, books and articles on adoption in healthcare and information available at BeBright. BeBright has published two books on the Dutch healthcare sector and possible scenarios that will shape the sector the next 15 to 20 years. Currently, they conduct research for the third book on technological innovations in the Dutch healthcare sector. They have therefore a significant amount of information on the actors, regulations, legislations, relations, and technological developments in the Dutch healthcare sector. Also, extensive information on specific cases of disruptive innovations in the healthcare sector and results of market entrance, use and results can be found at BeBright.

3.4.1 Case Studies

The collection of qualitative and quantitative data on the cases and internal adoption indicators was partly facilitated by BeBright as well. They have multiple partners and associates in the healthcare sector through which more information on specific cases could be obtained. Subsequently, most quantitative data could be collected from the surveys also held under a number of employees at BeBright.

First action after the selection of cases, a summary of the technology and the development process of the product were described. This information was gathered through desk research and collected from information send by the developers were possible. Then, this information together with the survey questions was used to determine the scores of the specific cases on the different adoption indicators (see for the results Table 9). The survey questions were based on the selection described in the first part of the operationalization (chapter 3.2). The author of this study first executed completion of the survey, but afterwards, per case, also three other people filled in the questionnaire. These people were selected on their recent involvement with technological innovations in the healthcare

sector. They were either students of 'Science and Innovation Management' or employees and trainees at BeBright. Thereby, they were able to evaluate and compare the performance of the disruptive innovations compared to other product introductions. The outcome of these surveys for each case can be requested, together with the credentials of all the people that were involved and the survey questions. The findings and their implications can be found in chapter 4.4 and 4.5. When an answer could not be formulated, due to lack of information for instance, the fields were left empty.

3.4.2 Context Factors

Qualitative data on the contextual factors was mainly collected from the interviews with experts. The questions of the interviews were based on the contextual indicators of the second part of the operationalization (table 2) in chapter 3.2. Due to the semi-structured character of the interviews, there were many opportunities for additional input by the experts, illuminating more on the matter at hand (Yin, 2009, p.106). Nevertheless, a disadvantage may have been that interviewees show biases in their answers due to social desirable answering or unclear questions and inaccuracy due to bad memory or incomplete knowledge (Yin, 2009, p. 102). The flexible, semi-structured nature of the questions made it possible to add questions during the interviews in response to what the interviewees had said. In this way, underlying motives, which could be of importance for the research, were obtained. The interview questions consisted of open and closed questions. Closed questions contained answer possibilities in Likert scale, which resulted in the gathering of specific information and helped later on in comparisons. Open questions were added in order to give the interviewee space to respond (broadly) by what came up spontaneously (Baarda en De Goede, 2006, p. 231). The processing of the interviews happened afterwards by refinement of the answers from recordings of the interviews. Afterwards, the written transcripts were sent to the interviewees for verification. The interview questions, the outcomes of the interviews, and an overview of the interviewees are given in Appendix B and C. The summarized results of this data are shown in chapter 4.2. In the next part, more on the analysis of the gathered data is explained.

3.5 Quality of the Research

The quality of this case study is based on the principles of construct validity, internal validity, external validity, and reliability described by Yin (2009).

3.5.1 Internal validity

Yin describes strong internal validity such that "*the independent variables influence only the dependent variable, and that no other factors influence the dependent variable more*". In this research, the internal validity was increased by evaluation of the suggested relations in the conceptual model. An increase the internal validity of the research was also obtained by executing the survey studies with more people, interviews, and literature study to verify the relations of the model.

3.5.2 Construct validity

The construct validity was aimed at the development of a sufficiently operational set of measurements for the concepts being studied. To increase the construct validity, multiple sources of evidence were used (Yin, 2009, p. 41). The multiple sources of evidence were (academic) literature, complemented with case surveys under multiple people and interviews with experts to verify the literature. Within those cases, multiple sources for one indicator were obtained by contemplating the results with other 'objective' experts from the field. This prevented possible dissensions due to selective perceptions of one specific interviewee. Also, by testing concepts of the theoretical model with more than one indicator, the construct validity was enhanced.

3.5.3 External validity

The external validity is aimed at the generalization of the findings beyond the specific case study (Yin, 2009, p. 43). Due to the limited size – a minimum of 15 cases – of this study, it was difficult to generalize any findings to the entire sector. This research was accordingly designed with a more exploratory character to investigate a new research field. Also, the selection of the cases was not done randomly either, making the applicability limited to the selected areas and backgrounds. Further research can however lead to results that are more generalizable.

3.5.4 Reliability

The goal of the reliability test is to gather the same findings in a later investigation, while following the same procedures and evaluating the same case studies as the earlier research. To minimize errors and biases, the research contains the highest degree of operational steps (Yin, 2009, p. 45). By providing founded argumentation and elaboration for the operationalization and making the questionnaire and interview questions understandable and unambiguous as possible, it is aimed to maximize the reliability of this study.

3.6 Data Analysis

For the analysis of this research, a comparison model was used. This model tests whether the context factors and adoption factors of cases fit together and both stimulate the adoption of an innovation. The questions were designed in such way that similarities and differences per indicator could become visible. This emerges when the MLP of the technology area has certain features or demands that a product either meets or not. The processing of qualitative data was done at the start. First, the analysis of the context indicators is described, followed by the internal adoption indicators and finally how the comparison analysis was performed.

3.6.1 Analysis Context Indicators

All indicators from the operationalization (table 2) could be scored on a Likert scale. This Likert scale score was used as the example in table 3 shows. The example has five options from 1 'never' to 5 'always'. When the score was between 1 and 2, it was interpreted as 'negative for adoption of innovations' and scored a '-' in the results table; when the scores or averages were between 2.1 and 3.9, they were interpreted as 'neither negative or positive for adoptions of innovations' and scored a '0'; when the score was from 4 to 5, it was interpreted as 'positive for adoption of innovations' and graded by '+' (based on the method of Faber and Moors, 2007). See table 8 in the next chapter for an overview of the scores.

Table 3: Likert Scale Context Indicators

Never	Sometimes	Average	Often	Always
1	2	3	4	5
--	-	0	+	++
1-2		2.1-3.9		4-5
-		0		+

Followed by the summary of the interview results, a qualitative description and, where possible, an explanation of all the particular and outstanding (either a positive '+' or negative '-' score) findings concerning the adoption of innovations is given in chapter 4.2. These descriptions were mainly based on the answers to the open questions in the interviews or by additional desk research. The next section on 'implications' describes what the implications of these results are on the adoption of innovations, and completes this analysis. These implications explain the factors that producers of disruptive innovative products need to consider when launching their product. The selection of these factors has been done by careful categorization and recapitalisation of the qualitative results. It is assumed that when considering these factors and

acting upon them, producers can positively stimulate the adoption of the innovation.

3.6.2 Analysis Internal Adoption Indicators

For the analysis of the adoption indicators of the disruptive innovation cases, a similar method was used. As with the context indicators, all measurements could score from 1 to 5 on a Likert scale. These were however averages of four inputs of the four people that filled in the questionnaire per case. Therefore, when the majority and average score was between 1 and 2, it was interpreted as 'negative for adoption' and scored a '-' in the results table 9; when the average and the majority score was between 2.1 and 3.9, it was interpreted as 'neither negative or positive for adoption' and scored a '0'; when the score was 4 or higher, it was interpreted as 'positive for adoption' and graded by '+' (also based on the method of Faber and Moors, 2007). See also table 4.

Table 4: Likert Scale Internal Adoption Indicators

Never	Sometimes	Average	Often	Always
1	2	3	4	5
--	-	0	+	++
1-2		2.1-3.9		4-5
-		0		+

The case descriptions (chapter 4.4.1 until 4.4.14) further elaborate on all the particular and outstanding findings of the data collection how they either negatively or positively influenced the adoption of that specific innovation.

3.6.3 Comparison Cases

A comparison between successfully and unsuccessfully implemented technologies was assumed to provide more clarity on which indicators are expected to be of significant influence. The first level of comparison is therefore focused on finding these differences and similarities between successful and unsuccessful cases in the internal factors. First, the recapitulation of all the results from the cases was made with the method described before. Afterwards, in that overview, the cases were differentiated on technology area and success (see table 9). Subsequently, the significant differences in scores between the successful and unsuccessful cases per technology area were highlighted. In table 5 below, an example of this is shown. When there was a significant difference in the scores between successful and unsuccessful cases, this was considered as a potential important indicator. Other indicators, where either all scores were equal or too many differences, these were considered insignificant for this study.

Table 5: Comparison Successful and Unsuccessful Cases

	Successful			Unsuccessful		
Number of adjustments necessary	0	+	+	+	+	+
Fits type of evidence required by users	+	+	+	0	0	0

3.6.4 Consideration of Cases and Context Factors

From the context study, a set of 20 significant factors was abstracted. The cases were tested for these factors; whether or not they used or considered them[*]. If information was not directly available from the earlier research, additional investigation was performed to answer the question. When it was clear that the producers of a case definitely conducted actions in favour of the factor were noted as '+'. When it was sure that they did not conduct any action in favour of the specific factors, it was denoted with '-'. When the information was not available or not applicable in that specific case, it was denoted as '*'.

[*] In the case of factor number 20, only the cases from the medical and pharmaceutical technology field were considered, as this factor was only applicable to these fields.

Subsequently, following the same method as described in table 5, the significant differences were withdrawn from the results. However, where the extensiveness of general results from this method was disappointing, the factors were judged independently per case. Based on the qualitative data of these cases, crucial factors could be identified that might have caused the failure up until this point for that specific case. An example is given in table 6. Together with the results from the other technology type, most producers showed knowledge of regulations, except for one. This seemed hence a crucial factor for success.

Table 6: Consideration of Cases and Context factors

	Successful			**Unsuccessful**			
Knowledge of regulations	+	+	+	-	*	*	*

4. Results

In this chapter, the results of the interviews and the case study analyses are represented. The results were obtained and processed by the methods described in the previous chapter.

4.1 Selection of Cases

In total, 14 examples of past and present disruptive technologies were selected.

Table 7: Cases of Disruptive Innovations		
	Year	**Technology Area**
Adoption level: Successful		
1. Buurtzorg	2006	ICT
2. Angioplasty	1964	MedTech
3. Home pregnancy test	1970	MedTech
4. E-prescriptions	±2000	ICT
5. Independent Specialized Clinics (ZBCs)	1998	MedTech
6. Zorgdomein	1997	ICT
7. KPN: Trees	2012	ICT
Adoption level: Unsuccessful		
8. Mammaprint	2003	MedTech
9. Polypil	2003	Pharma
10. DiabetesStation	2010	ICT
11. All-in-One Device Diabetes	2010	MedTech
12. Tele-health	±2000	ICT
13. Mobile and Accessible Ultrasounds imaging	2009	MedTech
14. TVfoon	2006	ICT

The results from the interviews are described and analysed first, because they set the context for this study.

4.2 Context Indicators

In total, five interviews of 1.5 to 2 hours were held with experts from the healthcare sector in The Netherlands, but also with main players in the technology sectors. In appendix B and C an overview of the people, their background, and the transcript of the interviews are given. In table 8, the overall results from the interviews on the context indicators are given first. These findings were processed as was described in the previous chapter, section 3.6.1. Below the table, the results are described per pillar of the regime. Remarkable differences between technology areas that have emerged during the interviews with the experts are defined per area after a description of and elaboration on the Dutch healthcare sector in general.

Table 8: Score on Context Indicators per sector					
Nr.	**Indicator**	**Healthcare sector General**	**Medical Technologies**	**Pharmaceutical Technologies**	**ICT/e-Health technologies**
Application Domain					
1.	Openness to new applications and technology	0	0	0	0
2.	Size of patient group influence on the diffusion of innovations	0	0	+	+
3.	Severity of disease influence on the diffusion of innovations	+	0	+	+
4.	Is the implementation time for new technology long?	-	-	-	0
Culture					
5.	Open to external advice?	0	+	0	-

6.	The importance of status	-	-	-	-
7.	The importance of prestige	-	-	-	-
8.	Level of cultural traditions	-	-	-	-
9.	Cultural homogeneity	*	0	0	0
10.	Necessity for prototypes	-	-	-	-
11.	Necessity for pilots	-	-	-	-
Networks					
12.	Size and complexity of networks	-	-	-	0
13.	Strength and closeness of relations	+	0	0	-
14.	Is the number of parties generally involved in implementing a new technology high or low?	*	*	+	*
15.	Is it hard to meet the credentials required for acceptance?	-	-	-	0
16.	Is information openly available?	-	+	+	0
17.	Is communication open	-	+	+	-
18.	The importance of authority	-	-	*	+
19.	Is the network density high or low?	-	-	0	0
20.	Personal relations between actors at CEO level	-	0	+	+
21.	Is the level of coercion high?	0	+	0	0
22.	Is the innovation-related knowledge of the involved actors high?	-	0	0	-
Politics					
23.	Is the number of political bodies high?	0	0	0	0
24.	Is the situation stable?	-	+	+	+
25.	Is the severity of the disease of influence on policy?	+	+	+	*
26.	Do polity changes take long?	0	0	0	0
27.	Is bureaucracy an impediment factor?	-	-	-	-
28.	Protection for domestic or existing technology	+	0	-	+
29.	Are subsidies going to the right place?	0	0	0	0
Technology					
30.	Availability of new technology	+	0	0	0
31.	Complexity of existing technology	0	0	0	+
32.	Height of existing research investments	0	0	-	0
33.	Presence of uniformity or standardization in this sector	0	0	0	0
34.	Correct use of uniformity or standardization	-	0	*	*
35.	Appearance of imitations	0	-	+	0
Infrastructure					
36.	Professional boundaries	-	-	-	-
37.	Diffusion over professional boundaries	0	-	0	0
38.	Organizational boundaries	-	-	+	-
39.	Diffusion over organizational boundaries	0	0	0	0
Scientific Knowledge					
40.	Availability of scientific knowledge	+	+	+	+
41.	Complexity of scientific knowledge	0	-	0	+
42.	Education level of users	0	+	+	0

4.2.1 The Dutch Healthcare Sector

Application domain

The application domain consists of patients, doctors (generalists and specialists), nursing staff, other caring professions such as physical therapists and psychologists, but for the larger investments also entire healthcare institutions. Because the application domain is such a large group and consists of so many different types of people, the level of acceptance of new technology depends on their qualifications and personality.

So when looking at patients, "*the elderly tend to expect personal contact and conventional methods of treatment. They are not so impressed by new technical gadgets or changes in the system. Younger patients are regularly more open to new methods and technology, and they even seem to expect this*" (Van Schaik). Overall, patients are likely to prefer the options that generate the best results and take the smallest effort and no extra payment. Additionally, a large share of the patients is continuously changing or 'new', making the adoption of new technology potentially easier than for the professionals who have developed their methods over time.

Medical professionals are most of the time very conservative when dealing with social innovative solutions. In these cases, they have to change their habits and, for example, give more responsibility to the patients themselves or learn how to work with new ICT systems. "*Resistance often seems to originate in personal insecurity or limitations*" (Wittop Koning). Nonetheless, when dealing with new medical technology, they are more likely to try-out and follow classes to keep up-to-date with the newest technical gadgets. "*The large number of new, big medical devices is proof for that*" (Van Schaik).

The diffusion of new technology takes relatively long in the healthcare sector (Van Schaik). This is mainly caused by all the regulative boundaries that are installed to ensure safety. Of course, it does depend on the type of technology. When a medical technology is more complex, it can take up to an average of 16 years from fundamental research to market implementation. When looking at a more 'social' innovation such as the use of social media, this time is shorter. The impact a potential innovation can have also has an influence on the diffusion time. The more severe and complex a disease is, the more likely it is that personal curiosity of medical professionals speeds up the diffusion time of new technologies. This does on the other hand result in less interest for the chronic diseases and potential longer implementation time (Van Schaik).

The size of a patient group does not have a significant influence. "*Eventually, when the size of the group reaches a certain limit, it can definitely force some changes. Before that however, medical professionals tend to work 'harder' – in other words, see more patients – at first, before they implement disruptive changes in their work. These disruptive solutions often come from the outside*" (Van Schaik).

Culture

The Dutch healthcare is still a very traditional sector based on a 'guild' type of system, strengthened by the national boundaries (Van Schaik; Egger). Educational processes find their fundaments in the master versus pupil systems. This makes the underlying relationships very hierarchical. For producers of healthcare technology this also matters. They have to sell their products to the doctors, whom determine which products are used by anyone in their field, or at least their subordinates. These terms are however changing the last couple of years. Increasingly often, producers sell their products to hospitals or the institutions employing the doctors. "*Medical professionals are not anymore 'self-employed' in independent medical partnerships as often as before. This means that*

integrated payment systems and rationalized purchases happen more frequently" (Van Schaik).

Besides the differences in adoption choices, the two types of customers (medical professionals and institutes) also have different attitudes towards external advice. Medical professionals or researchers tend to be driven by the content of their profession. They are therefore less prone to accept external advice. Management surrounding healthcare is more prone to use knowledge and skills from other sectors or professions (Van Schaik; Koolen).

The cultural traditions are closely related to the importance of status and prestige in this sector. When introducing a new product in this market, it is very important to have the support of some renowned medical expert or institute. Newcomers have to put in considerable effort to meet all the requirements that one needs when introducing a new product. Solely the scientific proof is not enough. Approval for compensation, substantiation of service and continuity, etc. is essential for adoption. Hence, it works both ways: producers with higher status and prestige have better contacts and more resources to last the research and adoption phases, but high status and prestige as a medical expert or institute helps supporting and developing new products (Van Schaik; Egger; Koolen; Hofstraat; Wittop Koning).

For the introduction of new products in the healthcare sector, many regulatory steps should be passed before adoption can occur. Compensation by the healthcare insurers is the first requirement that almost any medicine or product needs (Van Schaik). This is because Dutch people expect all medical expenses to be covered by insurers, as opposed to other countries, where the personal share can go up to 100% (Hofstraat). To obtain approval for compensation from the CVZ (see the regime pillar 'Networks' for elaboration), producers need to deliver reports with scientific proof, added value, proof of safety, support by the medical professionals, cost efficiency, etc. To develop that paperwork, prototypes and pilot studies or clinical trials are necessary (Van Schaik; Egger; Koolen; Hofstraat; Wittop Koning). "*Also, for the optimal development of a product, often it is beneficial to collaborate with the end-users. Hence, that becomes more regular*" (Van Schaik). Maybe, in the case of small software updates or minor changes, prototypes can be omitted, but most of the time, all products need to be tested (Hofstraat; Wittop Koning). All in all, for new producers in the market, the existing culture makes it harder compared to the existing actors to ensure the acceptance of a new product.

Networks:

Compared to other sectors, the Dutch healthcare sector has many actors and complex ties within it. Many regulatory bodies work independently and focus on their specific field. Producers are however usually dependent of them to be able to market their products. Collaborations between producers and end-users are more common, but yet not as often (Van Schaik). For an overview of the relevant actors in the sector, see figure 6 on the next page. For an elaborate description of all the actors, see Appendix D. Major parties still missing in this overview are *"the financers and employers who respectively invest a large number in research and development of new products and pay 50% of the healthcare costs*" (Van Schaik).

The number and characters of producers, distributors, and users are very high and diverse. For the larger and more expensive products, only a few multinationals are of importance worldwide. Smaller products can be more localized and organized by smaller players. Often, these small companies receive support from the large businesses as an investment for the future (Koolen; Wittop Koning). These new and smaller actors have more difficulty in meeting the requirements of the sector, "*because they have no track-record in providing quality, continuity, service, up-scaling possibilities, etc.*" (Van Schaik; Egger; Hofstraat). This is very closely related to the cultural aspects within the sector.

Information on the products and research the actors are doing is not always available. They are available when (parts of) products are patented; then they are also freely published. Another reason is when there is some form of collaboration with a knowledge institute, because that ensures that there is some form of publication in scientific journals. A last reason is that pharmaceutical companies, for example, are more often obligated to publish all their trial results. Nonetheless, this does not necessarily mean that information can be used freely, that companies share all their secrets, or that people know what is going on in the sector. However, it is said that with the right effort and network, it is possible to know which company is focusing on what (Koolen; Van Schaik).

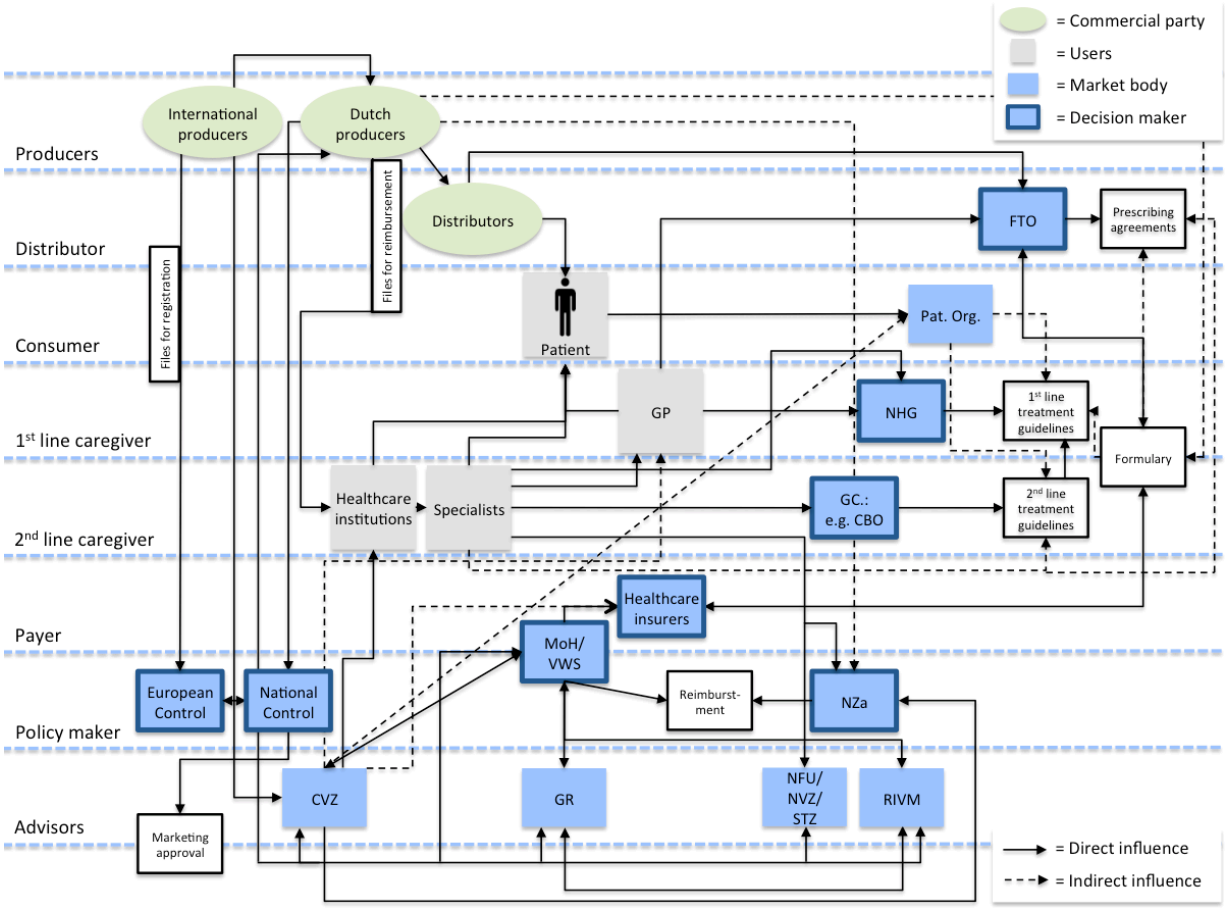


Figure 6: Overview of the Actors in Dutch Healthcare Sector (Based on overview BeBright, literature and interviews)
In this figure, the complex relations between all market actors are represented. Generally, producing companies have an international orientation, but as the healthcare sectors are organized nationally, they have national departments as well. For the Dutch market, producers file for registration at European and National level (for example the EMA and the CBG). This is for the most part to ensure safety checks. Simultaneously, products need to be approved by regulatory boards such as the CVZ (to ensure compensation by insurers), but also the GR and NZa. After approval, the users – hospitals, specialists, GP's, pharmacists, and patients – receive payment from the Ministry of VWS and Healthcare insurers. At the same time, the medical professionals and related representative organizations decide on treatment and usage guidelines. Overall, patient organizations have an indirect influence on many of these decisions. More information on each body is given in Appendix D.

The interviewees were not as positive on the openness of communication between different parties in the Dutch healthcare sector. "*There is a lot of information available, but it seems to be very hard to share that information efficiently. An example for that is the infinite process to set up a central, electronic patient record system (EPD)*". One explanation for this is the hierarchical character of the sector and that medical professionals hesitate in sharing information. Moreover, topics such as privacy and safety are repeatedly used to counter implementation, even though the problems concerning lack in quality and reduced efficiency are not being solved (Van Schaik). Additionally, most of the time only the people that are involved with the development of an innovative product or service are aware of its existence. The spread of best-practice examples is relatively low (Van Schaik; Koning Wittop, 2013). This is of course different for specific products of large companies, which often have a marketing strategy to help adoption and spread.

Related to this is the concept of 'open innovation'. There are some forms of so-called 'pre-competitive' research known, but they are not a standard phenomenon. The larger producers in the field have some form of contact, but that is very limited to "*shared challenges and developing ideas to improve the innovation in the sector itself. They try to avoid all appearance of price fixing*" (Hofstraat; Koolen).

Politics

The political actors in the healthcare sector are also visible in figure 6 as the 'decision makers' and 'market bodies'. In this situation, the decision makers determine the regulatory and legislative processes in the Dutch healthcare sector. The market bodies can each in their own field and expertise influence or advice the decision makers. These bodies are known to be independent and not tied to commercial parties. The present situation is however moving towards a system similar to the FDA in the United States. In such system, one advisory board controls and certifies products that enter all national healthcare markets. This does not have to be one organization, but can be multiple institutes specialized in, for example, pharmaceuticals, medical technology, or food (Van Schaik).

Patient organizations, supported by influential public figures, different unions, and provinces with subsidy potential are all able to influence the political decisions in the Dutch healthcare sector. Also, because of the privatization of actors and many commercial parties, companies in the Dutch healthcare sector are more frequently under the supervision of the European government. "*A new major actor in the near future in the Dutch system will be the municipality. Municipalities will, for instance, have the responsibility over budget distribution concerning the Exceptional Medical Expenses Act (AWBZ). Logically, they will become a more prominent actor in the political field and be more involved in the decision making process*" (Van Schaik).

The situation is relatively stable, meaning that the process with all controlling steps is not likely to change fast any time soon (Egger; Koolen; Hofstraat; Wittop Koning). Nonetheless, the sector is in transition. First, transparency and competition will be more common. This creates a different atmosphere for all actors in the sector. Second, due to the poor economic situation, budget cuts will force changes (Koolen). On the other side, this also makes 'unpopular' measures possible. Third, "*it is likely that healthcare will become more intertwined with other public tasks of the Dutch government such as social housing and pensions*" (Van Schaik). Besides the fundamental changes in the healthcare sector, changes caused by 'short-term' motives or incidents aided by media attention can move political decisions in certain directions. It is questionable whether these are always the 'right' decisions (Van Schaik). Generally, it takes between the two and five years for regulations to change (Koolen).

In any case, there is a high level of bureaucracy, which is a delaying factor for the diffusion of innovations in the healthcare sector. The rigidity of the system enables people to hold on to the existing standards and practices

(Van Schaik). The safety checks on medication and medical devices ensure that much time and money is spent on bureaucratic processes (Koolen).

Many of the actors are officially commercial parties and operate in a 'free' market system. There is hence no domestic protection for existing products. The protection by patents does of course count as a form of protection, but that is not limited to specific (national) companies.

Subsidies are mainly going to fundamental research or pre-competitive research (Van Schaik; Hofstraat; Egger). Direct expenditures on R&D by the Dutch government ranged between the 176 and 160 million in 2013 (Van Steen, 2013). Around four times that number goes to healthcare in an indirect manner. This can be, for instance, via the funding of R&D in universities (Chivot, et al., 2012). This number will structurally decrease further until 2017 (Van Steen, 2013). These governmental subsidies are however not going to bigger companies, but to SMEs (small and medium enterprises). For the large technological businesses, there are European subsidies. These subsidies are required to be spent on European collaboration, meaning that a Dutch company has to work with foreign institutes for example. "*This is an unfortunate situation, because for one, large innovative companies tend to move to other countries where they can apply for subsidies and thereby decrease the risks that come with research. Second, the tax benefits on R&D expenditures in The Netherlands are not able to control the focus or direction of research; something that subsidies can do*" (Hofstraat). This does not result in a better environment for the introduction of new products. A disadvantage of the focus merely on fundamental research is that the pragmatic use is sometimes lost. Academic freedom in research does not always fit in reality, making the subsidies not always beneficial for the sector. The amount of subsidy going to the launch of technology in the market thus needs to be increased (Van Schaik).

Technology

Overall, new technology is available on a regular basis in the healthcare sector. These are mainly medical technologies and ICT solutions. These innovation processes have however usually a 'technology push' nature, which makes the pragmatic outcome of it not always as high as would be desired (Van Schaik). The complexity of these new technologies varies per case and it ranges from very simple solutions to very complex products.

It seems to be very hard to standardize technology in this sector, besides the very large and expensive examples, such as MRI scanners and operation robots, which have standardized protocols. All the other technology, from ICT systems to smart at home devices, is very diverse and is not able to be exchanged or connect to the alternatives. The biggest challenge in here is to ensure that uniformity and connection can be realised, which will help the sector to be much more efficient (Van Schaik; Hofstraat; Koning Wittop, 2013).

Besides the investments from the government in the form of subsidies, there are also other sources of investments such as private equity funds, SME investments, healthcare insurers, and angel investors. Despite of the economic situation, which certainly puts pressure on these sources, the innovative companies receive funding for good ideas (Van Schaik). It remains unclear if these expenditures are high compared to other sectors. (For more information on the height of these investments, see Chivot, et al., 2012 and NVP, 2013).

Infrastructure

In the existing infrastructure of hospitals, care centres, and educational facilities, there are many professional and organizational boundaries. The existing rules of conduct, norms, patents, and protocols give very strict tasks and rules in how people and institutes behave and what they are allowed to do. This is also caused by the hierarchal nature of the culture in the sector and the safety measures that need to be considered.

Diffusion across these boundaries does not happen very often (Van Schaik; Egger; Koolen; Hofstraat; Wittop Koning). As was already said under the pillars 'networks' and 'politics', some changes ahead will maybe open the sector for opportunistic actors. The situation as it is now does however cause some difficulties for newcomers that want to introduce their products. They either need help from existing actors in the network, or they have to collect sufficient resources to fit into the system themselves.

Scientific Knowledge

The scientific knowledge in the healthcare sector is widely available. Much of the information is either published or patented. It does not necessarily mean that everyone is aware of that knowledge (Van Schaik). Also, "*when information is sensitive due to competition or safety, the availability is naturally reduced*" (Egger).

The education level of users is relatively high. Most medical professionals are educated at academic or higher education level. The education level aids the absorptive capacity, because as it is thought that the ability to absorb new information is related to the prior related knowledge; higher educated people should be able to adapt easier to new technology (Cohen and Levinthal, 1990; Nooteboom, 2000). Of course, patients vary much in their education level. Adoption of new technology and the potential responsibility shift that comes along with disruptive innovations is hence not necessarily fit to all users. It is therefore important that producers of innovative products either make the products so easy that the absorptive capacity cannot be impediment to diffusion in new markets, or that they focus on the groups that already use the technology. The latter ensures that no new knowledge needs to be developed.

4.2.2 Dutch Medical Technology Sector

During the preparation for this study, it became clear that there are some differences between the different fields of technology. These can influence the adoption of innovations. Therefore, this section focuses on the description of the differences or outstanding specialties for the medical technology area compared to the healthcare sector in general.

Application Domain

A producer in medical technology sector has to follow all the general regulatory processes to introduce new products. The adoption speed is not as much influenced by the severity of a disease or the size of the patient group. The first can however cause "*increased speed in adoption when a technology offers a treatment for a disease that so far did not have a cure or treatment. Most additional technologies do not have that advantage, and will thereby not be influence by the severity of a disease*" (Hofstraat; Egger).

Culture

Compared to the healthcare sector in general, it seems that the medical technology sector is more open to external advice and influences than other areas. For one, the sector is very 'innovation minded', meaning that all possible answers to new ideas are welcome (Egger). This also becomes apparent in the fact that businesses in these sectors are more open to concepts such as 'open innovation' and collaborative projects (Hofstraat; Egger).

Networks

All electronic devices, machines, lifts, meters, safety equipment, etc. sold in the European Economic Area (EEA) need to be marked with a CE-mark. This marking means that the product conforms to the set directives based on safety. There are different Dutch and European authorities that are certified to issue CE-marks (Hofstraat; Egger). To regulate these

agreements, the EU has department specialized in medical devices. "*They are concerned with the regulatory framework for market access, international trade relations, scientific and technical assessment, and regulatory convergence, all aiming to ensure the highest level of patient safety, while promoting competition and innovation*" (EU Public Health, 2013).

Politics

The political situation is practically similar to the description in the previous section. However, the protection of existing technology is essentially enforced by the registration and enforcement of patents. This gives an enormous advantage for the large companies that have the resources to employ legal departments and ensure that certain products will never be marketed in the Dutch healthcare sector (Hofstraat).

Technology

150 businesses with around 5,000 technological employees in The Netherlands develop medical technology. The total investments in medical technology R&D in The Netherlands alone are estimated between 320 and 400 million (from a Holland Healthtech research via Hofstraat). It needs to be considered that many companies have an international orientation and not all R&D investments are spent here.

Scientific Knowledge

The scientific knowledge in this sector is widely available. All technological information is either published, marketed, patented, or any combination of that. Besides, the average education level of the users is very high for medical technology. The more complicated the technology, habitually the higher the education level of the users (Hofstraat)

4.2.3 Dutch ICT-technology Sector

The ICT-technology sector also has differences with the healthcare sector.

Application Domain

'Difficulty' with the users in the healthcare sector is that there are many independent partnerships or businesses that decide for themselves which ICT programs or products they buy. "*Medical professionals usually guide patients in their choice for e-Health products. The introduction of a new product is therefore (only) possible when it is sold to all individually to all actors. The medical professional is often not sensitive to top down policy and prefers personal contact and service when considering an innovative solution*" (Wittop Koning).

Influence of the patient group size and the severity of a disease cause some minor advantages for adoption. First, because the commercial parties see a business case in a certain area and second, when quality of treatment can increase, the users (in this case medical professionals) are more likely to accept an innovation faster.

Another difference in the ICT-technology sector is that many of the products do not necessarily require compensation by insurance companies. The higher 'quality' must be, often when the technology is more related to healthcare, the longer implementation takes. Also, the size of a product affects the implementation time; when a complete hospital has to implement an innovation, more people of different backgrounds need to be convinced. As approval from insurers or the CVZ is required, the implementation time can take 1.5 to 2 years longer than in the situation where it is not necessary. When it is not necessary, from idea to implementation it can happen as fast as a couple of months (Wittop Koning).

Culture

For outsiders it is much harder to introduce new products in the Dutch healthcare sector, triggered by the existing environment (and networks) that which evolved over time. "*For one, there are a few major producers*

of healthcare ICT (for example Chipsoft and TSS Software) that have over 80% of the market share in a specific part of the hospital ICT. These businesses are also able to 'boycott' the introduction of new products". On top of that is the dependence on individuals (medical specialists), whom can determine the success of a product. To be able to introduce an innovation, producers need a solid network with renowned leaders that adopt quickly (Wittop Koning).

Networks

The network of ICT-technology is less complex compared to other technology fields. For most products, the only involved actors are the producers and users. In some cases, there is involvement of healthcare insurers and interest groups. During the development phases of innovations, the producers and users work together. The relations are hence very close and helpful in future projects or challenges. Because of the close relations, it is very important that producers have sufficient knowledge on the processes discussed. If not, they will loose the confidence the users have in them. Knowledge on the sector and technology is consequently one of the main credentials a producer needs for success in this field (Wittop Koning).

Politics

The direct influence of the Dutch government on measures in the healthcare sector is not so high. Many of the responsibilities lie with the insurers, healthcare institutes, and autonomous institutes. Producers can employ lobbyists to try and change some of the procedures of the government, but the effects are questionable. Incident driven measures can still occur, but they are often very short-term oriented (Wittop Koning).

Technology

"*The underlying technology in the ICT field is not complex at all. The difficulty lies with the implementation and processes*" (Wittop Koning). The challenges are therefore much more focused on social innovation.

4.2.4 Dutch Pharmaceutical Sector

Finally, the differences with the Dutch healthcare sector or outstanding findings of the pharma-technology sector are described below.

Application Domain:

In the pharmaceutical sector, the size of the patient group is a large stimulant to invest in new technology, and eventually also for the sector to adopt that technology. Besides the size, the severity of a disease motivates patient organizations or other lobbyists to positively stimulate the flow of new medication (Koolen).

Culture:

The pharmaceutical industry is traditionally a very closed and competitive field. Protection by patents and ruthless pursuance of them form the culture. During the first twenty years of a patented product, multinational pharmaceuticals can behave as monopolists (or oligopolists) for that specific medication. Meanwhile, no company has a bigger share than 5% of the world market and there are only around a hundred companies worldwide (Koolen). As the pipeline of pharmaceutical companies is not as promising as it was twenty years ago, the sector is changing. Outsiders are, for example, more and more allowed to use patents from the big companies. Another change is the movement towards increased transparency in the clinical trial results. It can be said that the pharmaceutical industry is slowly opening up to the outside world (Koolen).

Networks:

In the Dutch pharmaceutical network, there are some specific actors. These are for instance the EMA (European Medicines Agency), the CBG

(Centraal Bureau Geneesmiddelen), the CFH (Commissie Farmaceutische Hulp), Nefarma, and for vaccines the NVI (Nederlands Vaccin Instituut) and DVG (Dutch Vaccines Group). See for an elaborate description of these actors Appendix D. Nevertheless, compared to other technology fields, the pharmaceutical technology area has a less dense network. They are strictly regulated by governmental rules and after past mistakes, they tend to uphold all competition rules.

Politics

Subsidies generally do not go to large businesses. There are exceptions when it concerns research to, for example, orphans drugs. National or European funds can offer stimulation or guidance.

Not so long ago, policy in the pharmaceutical technology area caused the prices of medication to drop drastically. Because insurers were allowed to demand prescription of the drug with the lowest price, there was a competitive battle in lowering the prices. This eventually caused a drop of almost 90% in price in a couple of months (Koolen). This means that policy can certainly cause drastic changes.

Technology

New technology does not appear as often in the pharmaceutical industry. Last year, only 27 new medications received approval from the FDA (Koolen). It is estimated that in Europe the research investments were around 28 billion EUR. The latest numbers for The Netherlands were from 2006 where around 0.1% of the GDP was spend on R&D to pharmaceuticals (equals around 540 million). Compared to other European countries or the US, this is relatively low (Chivot, et al., 2012).

Another phenomenon in the pharmaceutical technology field is that of imitations. There are many so-called 'me2-companies', or 'generic pharmaceuticals', that have a business model based on the production of medication that is no longer patented. They did not spend billions of Euros on R&D, but make a business in copying existing drugs.

Infrastructure:

The complete pharmaceutical technology area is built on investments. The research costs for new drugs are so high (over 1 billion per drug over eight years). The performance of these producers is based on the number of drugs that will be launched in the next couple of years. Also, the investments and support in small technological research companies is an example of this. These SMEs have as a business model to be bought or taken over by the large corporations. These investments give the large businesses a right to exist.

The latter leads to the fact that during this study, except for one, no examples of successful disruptive innovations were found. Therefore, it was decided to leave out the comparison for pharmaceutical innovations cases as well. Nonetheless, there are multiple ideas for the introduction of other technology in the pharmaceutical field that can potentially be disruptive. They are more focused on the administration and registration of medication use. So far, however, they unfortunately could not serve as cases for this study.

4.3 Implications of the Context for Adoption of Innovations

All findings from the context considered, producers of innovative solutions should consider the following factors per pillar. The fit to the context is higher when new products or the producers have considered these factors. Networks and Infrastructure were combined as during the interviews it became apparent that they are much interrelated.

Application Domain

1. Specification of actions per type of user: This is to gain acceptance of a type of user, but often this should be the medical professional, because they also reach the patients.
2. Personal contact: Producers of disruptive innovations should spend personal time with the users to stimulate adoption.
3. Education of users: This should help overcome resistance of the users. Simplicity of the product makes this of less importance.
4. Patience and resources: It must be taken into account that implementation time can take up to 16 years. The resources and business plan must fit the requirements of the sector.

Culture

5. Knowledge of cultural traditions: Producers of disruptive innovations have to deal with the rigid and traditional culture of the healthcare sector and adhere to the existing rules of conduct and regulations.
6. Status: The support of a renowned, leading specialist whom is able to set a standard in his or her field helps reaching end-users.
7. Support from large actors: Producers can use the established order of large companies, by introducing not directly competing products so that they are willing and able to support innovative ideas.

Networks and Infrastructure

8. Knowledge of the network: The networks are very complex and when introducing a new product it is important to know which actors do what and what information is required to collect.
9. Collaboration: Either with users or knowledge institutes helps with introducing new products (also related to status).
10. Spread the knowledge: By using the right channels of communication and ensuring that best-practices are adopted further, the success of a product can spread more easily.
11. Adhere to the rules of conduct: When a product does not adhere to the existing rules of conduct, it will be harder to diffuse in the healthcare sector.

Politics

12. Knowledge of regulations: There are many decision makers and market bodies that all can prevent the adoption of an innovation.
13. Preparation for policy changes: A product must be able to survive potential changes in policy.
14. Independence from subsidies: Subsidies are definite. Innovations must generate their own return on investments to prove right of existence.

Technology

15. Technology on demand/market pull: The application of an innovation is often more sustainable when it was developed from the perspective of the market or users, instead of technology-push by producers.
16. Standardization: When products have the options to standardization, they can result in more disruption.
17. Return on Investment (ROI): When products interrupt existing investments it will be harder to be adopted.

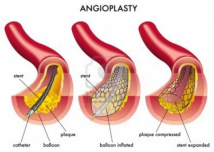
Scientific Knowledge

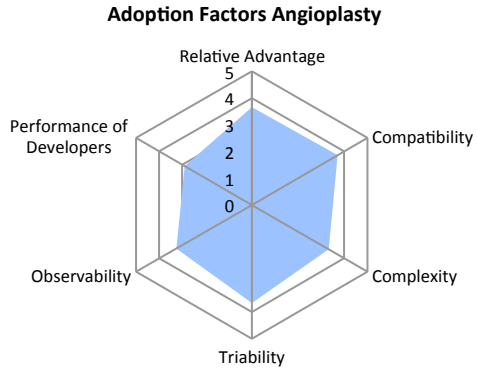
18. Careful use of sensitive information: Producers should be careful with the use of sensitive or competitive information. Large companies are very protective and can prevent market entrance.
19. Education level of the users: The higher the education level of the users, the easier they will develop new knowledge. However, the less education necessary, the better for the adoption.
20. Patents: In the *medical technology field*, patents are usually used. Producers should avoid using patented technology from other producers and should patent their own technological innovations.

4.4 Case Studies

To determine the influential indicators of adoption of disruptive innovations in the Dutch healthcare sector, the following cases were analysed (see for an overview table 7). The methods used are described in chapter 3. The recapitulation of the results of the surveys is shown in table 9. Because of the extensive tables and amount of collected data, all the results per case can be requested. In the next sections, the descriptions of the cases, development process, and the findings from the results are specified. Afterwards, the implications of these findings are described in the next section.

4.4.1 Successful – Non-Invasive Surgery by Angioplasty



Product Name:	Non-Invasive surgery: Angioplasty
Description:	Angioplasty is a technique through which medical professionals can mechanically widen narrowed or obstructed arteries while reaching the side by a catheter. At first, it was seen as an inferior and cheaper method compared to open heart surgery, and with lesser results. It was therefore only used in the simplest cases of clogged arteries. By now, angioplasty has become the standard over open heart and bypass surgery that can be performed in smaller, less specialized hospitals, or even in outpatient practices (Lee, 2012).
Disruptiveness:	Angioplasty has been a disruptive innovation because it was cheaper, not able to be used by the most complicated cases, and was thought to result in lower quality, but evolved over time as the preferred option. The technique was first used in other medical specialties before using it on cardiac patients.
Development Process:	The first report of surgery with angioplasty was in 1964 in the United States. Most surgeons were sceptical about the method, because they had to change their way of operating. Most cardiologists were very optimistic, as they had new ways of treating patients with ischemic heart disease. The number of cardiovascular angioplasty procedures in the U.S., show to increase considerably over the last 40 years, at a certain point bypassing the number of open heart bypass procedures (Hwang, 2012).
Users:	Cardiac surgeons, cardiologists, (and patients indirectly)
Involved actors:	Patients, medical professionals, hospitals, insurers
Score on Adoption Factors:	
Relative Advantage:	The relative advantage for Angioplasty is relatively high because of the user friendliness of the procedure. Many more patients can be treated this way, which also gives it an advantage to open heart surgery or other alternatives.

Compatibility: The compatibility of Angioplasty is high because the procedure fit in the existing network structures and had the possibility to become standardized over the alternatives. It did however cause changes in the relations between cardiologists and cardiac surgeons.

Complexity: The complexity fit the users.

Observability: Many involved users were very optimistic and 'spread the word' on the possibilities of Angioplasty.

Triability: Trials and pilots were held before the procedure became more and more standardized. Furthermore, similar procedures were conducted in other types of treatments, which increased the knowledge on the procedure.

Performance of developers: The introduction of angioplasty was done in more or less the same way as other introduction of other surgical procedures.

4.4.2 Successful – Home Pregnancy Tests

Product Name: Home Pregnancy Test

Description: Since 1930, people have known how to determine pregnancy from blood and urine tests. However, in 1976, the first home-test kits were developed and at the end of the seventies, these tests were marketed in the United States and Europe. From that point on, women were able to test whether they pregnant at home without needing to involve a GP or other medical specialist.

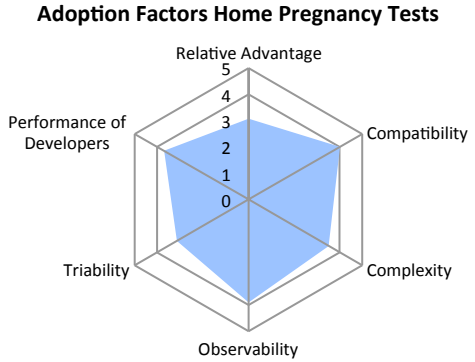
Disruptiveness: The introduction of this self-test caused a professional disruption. GPs were no longer necessary to perform this test. Moreover, due to the simplicity of the test and no need for professional diagnostics, the costs have become even lower and paid by the consumers.

Development Process: Research to pregnancy tests was increased as an answer to the so-called 'sexual revolution' in which more attention came for prenatal care and legal abortion and thereby the desire to detect pregnancy as early as possible. The first simple tests – the 'Error Proof Test' (EPT), Predictor, ACU-TEST, and Answer – were registered at the FDA in 1976. In that year, multiple 'commercial' actions in women magazines and at pharmacists promoted the 'privacy and time savings' that home tests would promote. Also, the possibility to consider abortion and changing your health habits in favour of the fetus were mentioned in the campaigns (NIH, 2003).

Users: (Sexually active) women

Involved actors: Patients, GPs, gynaecologists

Score on adoption factors:



Relative Advantage: The main selling point for the home pregnancy test is the privacy and easy access that women have. The user friendliness creates therefore a huge relative advantage. Besides that, the test needed to go through all the same procedures as similar products.

Compatibility: As not much new knowledge needs to be created and the tests could be purchased privately, the compatibility of the test to the sector was very high.

Complexity: The product is not at all complex to use, therefore it scores a little over average on complexity. The scientific knowledge behind the product is however easily mimicked, so there were many alternatives at the time.

Observability: There was a lot of media attention from pharmacists, drugstores, and women's magazines.

Triability: This was done according to the regular standards of the sector.

Performance of developers: The developers followed the rules of the sector and used different types of media to promote the product.

4.4.3 Successful – Independent Specialized Facilities (ZBCs)

Product Name: Independent Specialized Facility ('Zelfstandig behandelcentra': ZBC)

Description: These facilities provide specialized care, often in an outpatient setting focused on one medical area. One example is the 'Bergman Clinics' specialized in dermatological problems; another is the 'Xpertclinic', specialized in hand and wrist surgeries (Bergman clinics, 2013; Xpertclinic, 2013), but there are more than twenty different medical specialties offered by the existing clinics in The Netherlands (NZa, 2012).

By specializing in one area, remaining small and thereby reducing overhead costs, these ZBCs are often cheaper and more efficient than large hospitals. Due to small scale, they are able to provide high quality personal care. Generally, they start with the least complex operations, but as time has moved on, they have been able to perform more and more complex operations. Probably because of focus and specialization, the quality of the results is equal to or in some cases even higher than the large-scale, conventional institutions.

Disruptiveness: This innovative solution in the Dutch healthcare sector is disruptive because it provides the simplest solutions for the greater share of the least complex patients. They are cheaper and often independent from hospitals and the existing system. Overall, they create a disruption of healthcare institutions.

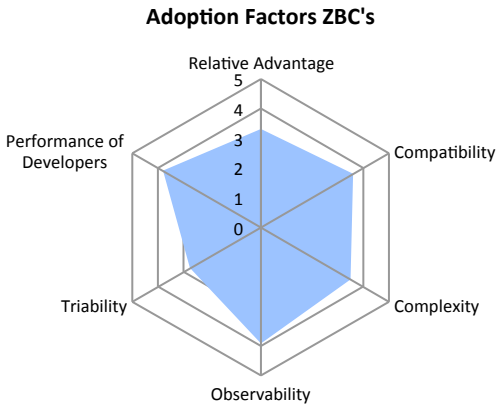
Development Process: In 1998, the Dutch government opened the opportunity for independent care facilities to start and offer specialized, competitive outpatient care in The Netherlands. In 2000, officially 45 outpatient institutions were changed into a ZBC concept. They proved to make the market more dynamic, but until 2003, permits were only granted as long as they proved to solve the waiting list problems and did not 'threaten' the medical activities of the existing hospitals. In January 2006, the bill 'Wet Toelating Zorginstellingen (WTZi)' changed the legislative

differences between ZBCs and hospitals opening up the market completely for any entrepreneurial activity in this front. The entrance of new ZBCs has continued to increase since 2007. At the end of 2010, 313 ZBCs were registered in The Netherlands (NZa, 2012).

Users: Patients, medical professionals

Involved actors: Patients, medical professionals, hospitals, insurers, regulatory boards, advisory boards

Score on adoption factors:



Relative Advantage: The relative advantage of ZBCs is based on the increased quality and focus against lower costs that they are able to realise. It does however not mean that other institutes are not able to perform the same procedures.

Compatibility: Partly due to the changes in policy, the ZBCs fit quite well in the existing network structure. Only the changes in habits of redirecting patients by GPs and the management structure of these ZBCs are different from the conventional institutes.

Complexity: The changes are not complex for users.

Observability: Some ZBCs are actively promoting their clinics and the positive results are widely spread by both the clinics and the insurers who pay for the treatments.

Triability: The triability is equal to other introductions of healthcare institutes in The Netherlands

Performance of developers: Most of the ZBCs waited until the market was ready for them. They ensured that the quality was relatively high, which made the adoption of the innovation much easier.

4.4.4 Unsuccessful – Mammaprint

Product Name: Mammaprint

Description: Mammaprint is a test designed by Agendia, which can assess the malignancy of the breast tumour more precise than any other existing test. It measures the expression of 1900 genes, and 70 specifically known to be involved in the course of breast cancer. It can predict the chance on aggressive spread of the tumour and thereby advice whether a breast conserving surgery is enough and if chemotherapy is required. It offers the patient and doctors to define a more personal course of treatment. In current clinical results, the test changes the course of treatment in 20% of the cases. It is even said that 50% of the patients currently receives 'unnecessary' chemotherapy (Mammaprint, 2013).

Disruptiveness: The mammaprint is a disruptive innovation because it

uses existing gene testing methods to determine or confirm a treatment path. It supports the decision making process from the oncologist and patient, and if accepted, can eliminate other steps in the diagnostic or treatment process.

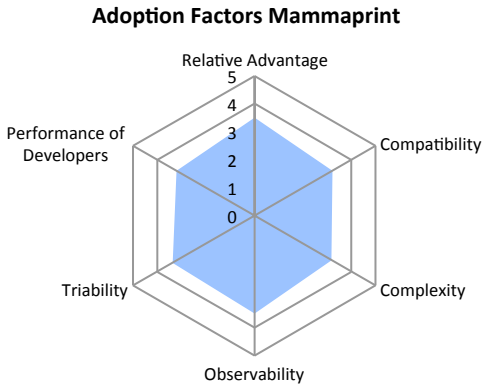
Development Process: Agendia was founded in 2003 by Dutch researchers. Based on research on 'historical' tissue and cases, together with the NKI (Dutch Cancer Institute) they identified the 70 genes that are related to the malignancy of a tumour. In 2007, they received approval for the Mammaprint from the FDA and the tests were introduced and used in almost all European countries and the United States. In 2008, they won the innovation price of the 'zorginnovatieplatform' in The Netherlands and the then minister of Health, Ab Klink, promised to support this test (Van Schaik). Up until now, they do still not have approval from the CVZ, whom determine whether health insurers must compensate for the test. They require ten years of clinical proof of the test and do not accept the 'historical research' as such. In 2010, Achmea was the first insurer that decided to compensate for the test, even without approval from the CVZ. They indicated that with this test, they can avoid unnecessary treatment and the costs would cover themselves with a more personalized treatment plan. In march 2013, the insurers count is up to seven, but there is still no official approval from the CVZ. To try and receive approval in 2015, Agendia has started new sets of clinical trials especially for The Netherlands. They need to show the clinical utility still counts 5 years after diagnosis, which, until now, was not confirmed by medical experts (Mammaprint, 2013; Hofstraat).

Note: In the U.S., Oncotype DX, a test similar to but less extensive than the Mammaprint, is being used and recommended by medical professionals. In the U.S. alone, they have a revenue twenty times higher than Agendia, but they do not have approval from the FDA (Hofstraat; Breastcancer.org, 2013).

Users: The users would be mainly women diagnosed with breast cancer and their medical professionals.

Involved actors: Patients, caregivers, hospitals, healthcare insurers, and regulatory boards.

Score on Adoption Factors:



Relative Advantage: The relative advantage of the Mammaprint over other products is quite high. Its performance is better than equivalent products and it can prevent very severe outcomes if not used. It also ensures that the users will not have to endure heavy operations when not necessary, but can set a realistic prognosis when spread of cancer is likely to occur and breast removal is the best option.

Compatibility: Not many adjustments need to be made for the

implementation of the Mammaprint. This also accounts for the development of new knowledge with the users, because it is compatible with the existing knowledge. Nonetheless, the Mammaprint experiences a mismatch with the type of evidence required by the sector. As they used historical tissue to develop the gene set, they thought to be able to market the test a lot earlier than conventional methods tell them to do. Generally, it is required to prove added medical value of new diagnostic tools over a period of ten years in use. This makes it 'impossible' for these tests to receive compensation for their costs.

Complexity: The complexity of the test is comparable to other genetic tests. One could even say that other processes are simplified by using this genetic testing. It is therefore that not much has to change to implement this innovation.

Observability: Trials of the tests have been similar to other tests. The opinions of experts have been divergent. Some have not seen enough proof that the test actually works the way Agendia promotes it. Agendia did then again generate a lot of positive media attention. This means that almost all medical professionals and involved actors have heard of the Mammaprint.

Triability: With the media attention and the historical research, one could say that the prototypes used by Agendia are quite high. The extend of the trials was thus far not so different from other technological introductions.

Performance of developers: The developers of Mammaprint used quite some media to promote their product. Besides legal paths such as registration with the FDA, they used a more 'popular' path, such as entering an innovation contest. Nonetheless, this media attention has not given the evidence that the CVZ demands to approve payment for this test. They are still missing the required clinical evidence of added value necessary for CVZ approval.

4.4.5 Unsuccessful – All-in-One Device Diabetes: 1Clik

Product Name: All-in-One Device for Diabetes: 1Clik

Description: 1Clik is an all-in-one insulin injector, glucose monitor and wireless communication system that helps Diabetes patients with their daily struggles in controlling their sugar levels. Especially children or elderly, who sometimes lose track of consistently monitoring and adapting their insulin intake, can benefit from this device. Real-time patient information and (verbal) instructions can help the patient prevent hypo- or hyperglycemia, but also provides caregivers, family, and friends with correct and up-to-date information. It is a cheaper and simpler device than previous options.

Nowadays, Diabetes patients have to purchase a glucose monitor, test strips (roughly $1 per strip), insulin, and syringes. With an all-in-one device like 1Clik, these costs are reduced and there will be less risk of communication loopholes between doctors and patients, mistakes, or wrong use (Sellars, 2013; BioSpectrum, 2013).

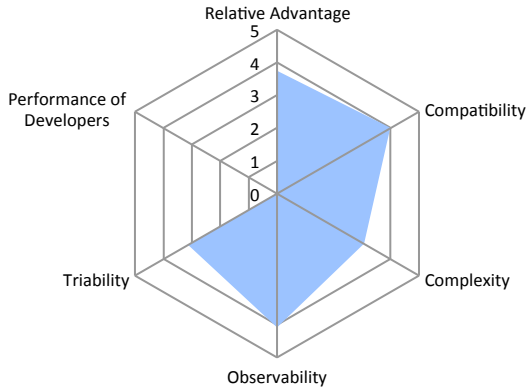
Disruptiveness: By using the knowledge of all separate devices and instructions concerning the administration of insulin by Diabetes patients, an all-in-one device such as 1Clik changes the life of many people. Doctors will have to spend less time in instructing patients in their use of insulin and the costs of healthcare products will decrease.

Users: Diabetes patients

Involved actors: Patients, medical professionals, pharmacists, healthcare insurers

Score on Adoption Factors:

Adoption Factors All-in-one Diabetes Devices: 1Clik



Relative Advantage: As with almost all the other disruptive innovations, the all-in-one diabetes devices have an increased user friendliness and thus higher quality for the users. As these products focus on Diabetes, their scope of patients is very big.

Compatibility: Many of the Diabetes patients already use glucose measurement and insulin injecting devices. These new products will only change that from multiple devices to one device, and hence, it is very compatible to the existing network.

Complexity: The complexity of the products is reduced, because less steps need to be taken by the users and therefore, less can go wrong.

Observability: There is much positive media attention for these types of devices. Trials and similar products are promoted in other countries than in The Netherlands.

Triability: As with other medical products, these devices have to be tested before they can be used in the Dutch healthcare sector.

Performance of developers: On the performance of the developers was not enough information available.

4.4.6 Unsuccessful – Mobile and Accessible Ultrasounds

Product Name: Mobile and Accessible Utrasound Devices: Mobisante

Description: This device is a handheld, mobile ultrasound apparatus that can visualize areas within the human body. In primary care, they are often used to examine soft tissues, small organs, vascular areas, implants, foreign bodies, etc. In secondary care, gynaecologists use ultrasound to examine pregnant women and their unborn child.

Disruptiveness: This device does nothing new compared to existing ultrasound devices, but is a cheaper and simpler version with the same quality. It opens the possibility

for primary care professionals to examine patients themselves, instead of referring them to specialists, saving costs along the whole line.

Development Process: Mobisante's Mobile ultrasound device was developed as a prototype by researchers from Microsoft Research and Washington University at St. Louis. In 2009, the entrepreneurs decided to commercialize the product after many positive reactions from the medical professionals in the United States. With help from different type of investors within the healthcare system, in 2011 they received clearance by the FDA and entered the market in October 2011. This made it the shortest time frame for any medical device to enter the market of the United States (Mobisante, 2013).

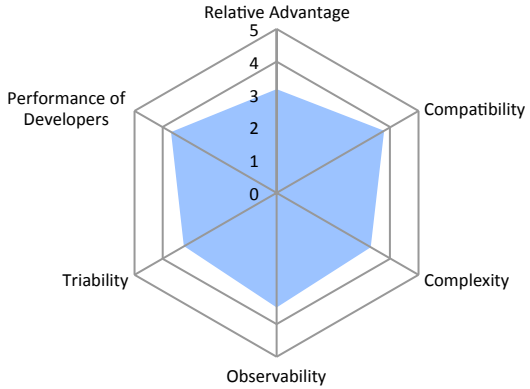
In The Netherlands, they are however not for sale (yet). The company is actively trying to enter European markets and third world countries. For the latter they co-operate with larger companies such as Siemens and Philips (Mobisante, 2013). The question arises whether it will ever happen in The Netherlands. An alternative, cheap ultrasound machine developed by Philips for midwives in Uganda is also sold in Germany to GP's. Dutch GP's or healthcare actors do not seem to show interest in such development (Hofstraat).

Users: Medical professionals (primary, secondary and tertiary)

Involved actors: Patients, medical professionals: midwives, GP's, gynaecologists, insurers, healthcare institutes

Score on Adoption Factors:

Adoption Factors Mobile and Accessible Ultrasound: Mobisante



Relative Advantage: The relative advantage of these products is caused by the mobility and price. They are much cheaper and usable under any circumstance.

Compatibility: The time to implement these products is quite low because of the simplicity. It does not require new knowledge to be developed, and it gives the same users the ability to use it in more locations and increases flexibility.

Complexity: Because the technology is not so advanced, the complexity is not a limiting factor in the adoption of this technology. Not many adjustments are required when implementing this technology.

Observability: The procedures are pretty much standard for this technology.

Triability: Prototypes were made and pilots were conducted as is required in this sector.

Performance of Developers: The developers have quite well defined their target markets.

4.4.7 Successful – Buurtzorg

Product Name: Buurtzorg

Description: Buurtzorg provides a simple, uniform ICT-system that helps local caregivers to provide (home) care in the region. Caregivers are employed by Buurtzorg and jump in on the demand of the needy, which are connected to the system as well. With personal monitoring and assistance based on disease or specific demand, they can adapt quickly to changing circumstances. In that way, the level of care is heightened.

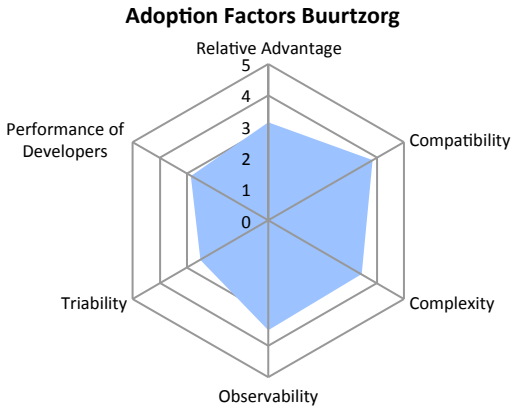
Disruptiveness: Buurtzorg uses the simple ICT-technology of connecting the right people and creating networks to create an easy access for all caregivers and people in need of help. The disruptive character lies in the fact that people can arrange a lot more by themselves in close proximity, without the involvement of large institutions.

Development Process: Since 2006, Buurtzorg is active in The Netherlands. Together with healthcare professionals (nurses, volunteers, home carers, etc.) Buurtzorg developed a basic ICT infrastructure, which can support the connection between (independent) local carers and patients. When a new client is interested, they develop on demand the essential structures for the local care.

Users: Patients, local medical professionals, organizations

Involved Actors: Patients, local medical professionals, healthcare organizations, insurers

Score on Adoption Factors:



Relative Advantage: This application makes it easier for the users to connect with each other than the conventional methods. It leaves much more freedom to the individual professionals and thereby, more flexibility for both users and suppliers of care.

Compatibility: The concept fits in relatively easy in the existing network structure. The evidence meets the demand of the users and the concept is easily standardized.

Complexity: The concept is not complex and therefore easy to use for both carers and patients.

Observability: There was quite a lot of promotion and marketing in de right circles when the concept was launched. Most of the homecare institutes and nursing facilities know of its existence.

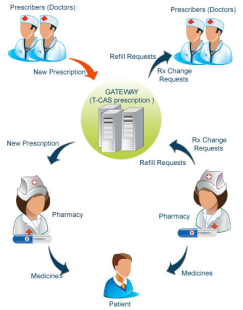
Triability: There were a couple of trials before the concept was

launched throughout The Netherlands.

Performance of Developers: Not much information was found on the development process of Buurtzorg. However, it is a fact that many of the potential customers is aware of the existence of Buurtzorg and the marketing methods seemed to fit the sector.

4.4.8 Successful – e-Prescriptions

Product Name: e-Prescriptions



Description: e-Prescriptions are medical prescriptions typically written by a physician that are written, transmitted and filed electronically. Pharmacists receive this prescription directly from the physician and they contact the receiver/patient. With this method, there is a smaller chance on mistakes and abuse and less time needed to transmit the message. The programs are able to help the physician selecting or changing the right medication and doses, but also view potential alternatives.

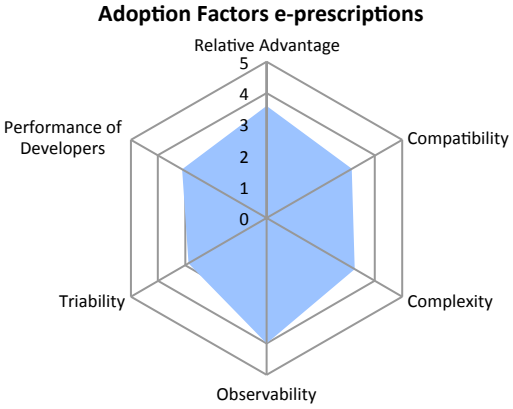
Disruptiveness: By implementing a relatively simple digital connection and filing system between physicians and pharmacists, tasks of the involved professions become better defined and with fewer overlap. The databases and software programmes take over basic (safety) checks and filing. This leaves the pharmacists to focus on the more accurate overview of the medication of the client and give advice on the use of the prescribed medication.

Development Process: Financial costs and measurable return on investments, management changes, hardware and software selections, errors, integrity of data input, security and privacy and system downtime were all factors that make the diffusion of this innovation hard. Nonetheless, in The Netherlands, since January 2012 it is prohibited to use handwritten prescriptions (Meernik, 2012).

Users: GPs, pharmacists

Involved actors: Patients, medical professionals, pharmacists, insurers

Score on Adoption Factors:



Relative Advantage: The relative advantage of e-prescriptions is based on the safety and user friendliness. With e-prescriptions, errors due to bad handwriting, forgery, or simply

	mistakes by medical professionals can be maximally limited. Besides, it can be used for more or less every patient going to a GP or needing medication.
Compatibility:	The system, once it was established, fit right in in the existing structure of the network. Administration processes were automated.
Complexity:	Establishing the system was however quite complex. Many adjustments were necessary as well as the 'persuasion' of the users that needed to learn new skills.
Observability:	There was a lot of media attention and there were many examples in other sectors that showed the possibilities of such system.
Triability:	Just like other ICT systems, the e-prescriptions were tested for functionality and safety before they were implemented in day-to-day practise.
Performance of Developers:	There is not much information available on the development process of one specific e-prescription program. There is however one big company that supplies 80% of the GPs with software and connection to pharmacists (Wittop Koning). At a certain point, they did therefore manage to gain enough support for their services. They were of course aided by the national obligation for medical professionals to use such system (Meernik, 2012).

4.4.9 Successful – Zorgdomein

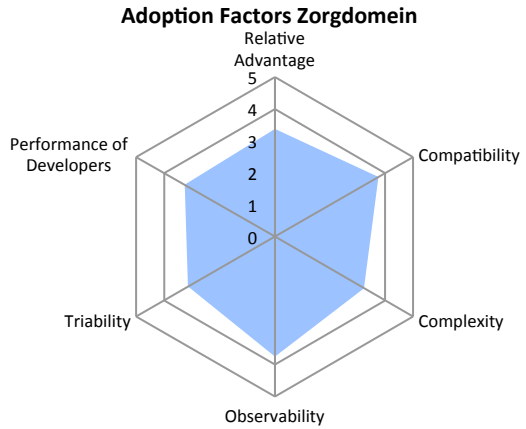
Product Name:	Zorgdomein
Description:	Zorgdomein is an organization that connects the different levels of healthcare (primary, secondary and tertiary). Their goal is to improve communication, efficiency, and information for all parties involved in referrals, prescriptions, consultations, and diagnoses. They digitalized and standardized communication between GPs and other caregivers on these four actions and try to link the separate database systems of these actors.
Disruptiveness:	By using a simple, relatively cheap, and standardized ICT-system to connect the involved actors, all the basic communication has become easier and more efficient. In most cases, it leaves out the written communication between different actors.
Development Process:	In 1997, Plexus developed a pilot referral model for the region Leiden. In this model, GPs were able to manage their referrals based on the substantive background of the patient. This meant that they could differentiate between complexity of medical content, urgency, and request for information. Subsequently, they could refer the patient to the right specialist in the best fitting hospital or institution. Because their own medical databases were also linked to this system, they did not have to replicate the information and saving a lot of time and prevent potential mistakes. In 2000, the first GPs were connected to

Zorgdomein. Currently, 70% of all GPs in The Netherlands are connected to the network of Zorgdomein. Additionally, 52 (of the 97) hospitals, 33 GGZ institutions, 36 ZBCs, and 1 home care facility are also using Zorgdomein for their communication with other caregivers. These numbers are still rising (Zorgdomein, 2013).

Users: General Practitioner, other care providers at all levels, care institutions

Involved actors: General Practitioner, other care providers at all levels, care institutions, insurers

Score on Adoption Factors:



Relative Advantage: The selling point of Zorgdomein is the increase in quality that it establishes by improving and streamlining referrals, prescriptions, consultations, and diagnoses. The scope of users (direct and indirect) is therefore very high and it proves to be very easy in use.

Compatibility: Not much needed to change in order for Zorgdomein to be implemented. Most of the GPs and other medical professionals already used some sort of system to refer patients. However, it was not as 'smart' as Zorgdomein. As it does not directly threaten anyone's business, it helps only to decrease waiting lists and improve quality of referrals.

Complexity: The system is not very complex for users. There are however a lot of users that need to be connected, which makes the total project quite complex.

Observability: First, there were trials at local level before the opportunity came for other regions to also use Zorgdomein. The opinions of experts were quite positive and the results were very promising.

Triability: They used a pilot study.

Performance of Developers: Together with the users, the producers of Zorgdomein developed the system in such a way that it met all the demands from the users.

4.4.10 Successful – Tréés

Product Name: Tréés

Description: Tréés is a mobile device or application that people with, for example, a mild form of Alzheimer can carry around, while it maintains continuous contact with either family, the care centre, or an emergency centre. To call or send a text message, the wearer does not need a telephone number, but can use the

pre-programmed keys. Additionally, the device has a GPS tracker, which enables the carers to track the person when necessary. Hence, in case of an emergency, either medical professionals or family can trace the location of the patient.

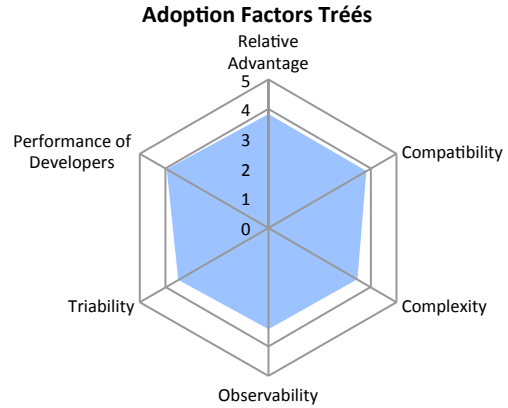
Disruptiveness: Tréés is a disruptive innovation because it uses simple mobile telephone and GPS technology in healthcare. By implementing this technology in healthcare, it enables people to be more independent and in less need for (human) attention or care. In other words, professional care can be taken over by family members, and a part of the responsibilities of family members can be taken over by the patient again.

Development Process: Based on British research, KPN decided to build a business case to help the elderly and chronic sick that are afraid to go out alone. Furthermore, the family members or carers could be supported by not having to worry all the time over the whereabouts and well-being of their 'sick' or 'lost' family members. They focused their products on patients, their carers, and healthcare institutes directly, meaning that there was no involvement or financial compensation by insurers. They developed four devices and a mobile application for smartphones. Besides, the service from the professional healthcare emergency centre is managed by KPN. This version of Tréés was launched at the end of 2012 (Wittop Koning; KPN, 2013).

Users: Patients, carers, medical professionals

Involved actors: Patients, carers, medical professionals

Score on Adoption Factors:



Relative Advantage: With the simplicity of Tréés, the user friendliness is very high. Additionally, with the possible solutions for emergency calls, the quality is also higher for patients and carers than the alternatives. The group of potential patients becomes larger every day as the aging of the population continues.

Compatibility: As there is no involvement of healthcare institutes or insurance companies, the compatibility of the product is very high. People can buy the device themselves and pay for it as well. Therefore, no adjustments or management changes are required for adoption. Moreover, the simplicity of the concept makes standardization very easy.

Complexity: Tréés is stripped to a device as simple as possible for patients to use and for carers to understand the added value that the product will bring. The product is however not as easy to mimic, because part of the service is the emergency call centre which is not possible for any company to replicate.

Observability: Similar products have been promoted besides Tréés. Also, users of the product have been very positive.

Triability: For new users there are free trials available to try for a month. The product has proven to work in mobile phones and other GPS devices.

Performance of Developers: As a very big business, the developers are aware of what steps they need to take to make the introduction of their product a success. They have deliberately chosen not to try and receive financial compensation for their product from healthcare insurers, as that delays the market entrance.

4.4.11 Unsuccessful – DiabetesStation

Product Name: DiabetesStation

Description: The 'DiabetesStation' is a device that gives people easy access to regular Diabetes check-ups. Diabetes patients are able to get the regular check-ups in their own time without an appointment and without the assistance of a medical professional. The patient performs the tests independently with instructions from the computer in their own language. The values are directly saved in the system and the computer can decide whether additional check-up with the doctor is required or not. The stations are located at convenient spots, which takes away reasons for patients of not going to these check-ups.

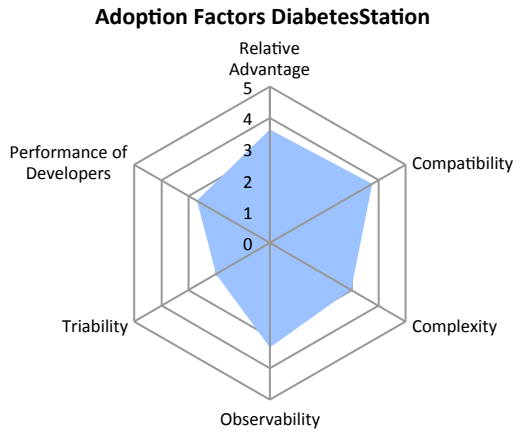
Disruptiveness: This DiabetesStation completely automates the check-ups for Diabetes patients. It hence changes the responsibility to the patients themselves and leaves the crucial cases for the medical professionals, saving time and money on both sides.

Development Process: In 2008, Prof. Dr. Sijbrands from the Erasmus MC in Rotterdam decided to automate a part of the regular check-ups and consults for Diabetes patients. The first motive for that was that there would be more and more Diabetes patients in the future, which would make it impossible for the current generation of medical professionals to see all these people regularly, or at all. Secondly, the device should make Diabetes consults more approachable for people that are hard to reach due to different cultures and language barriers. Together with IPT Telemedicine (part of KPN), they developed the first station that was installed in 2010 in the Erasmus MC (Diabetesvereniging, 2010). Nonetheless, after a year of trials, insurers did not want to compensate for the costs of the Stations. The financial model to support these automated check-ups was not irrefutable (Wittop Koning).

Users: Patients, medical professionals: midwives, GP's, gynaecologists

Involved actors: Patients, medical professionals: midwives, GP's, gynaecologists

Score on Adoption Factors:



Relative Advantage: The relative advantage of the DiabetesStation lies in the user friendliness of the concept. Its performance compared to other automated measurements is also thought to quite well. As there are more and more Diabetes patients each day, the scope of the patient group increases as well. Especially when considering the enormous amount of standard tests each patient has to conduct each quarter.

Compatibility: No new technology had to be developed for this station. Only an instructive computer program that guides the patients through the tests. The same program also has to be able to give advice based on the results of that moment. To use the station however, patients do not need to know more than they did before. All in all, the concept fits in the existing structure, but takes over part of the work of the internists or diabetes nurses.

Complexity: The complexity of the station is not higher than the existing alternatives.

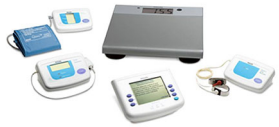
Observability: One trial was held in the Erasmus MC in Rotterdam and there was in the right circles quite some media attention.

Triability: The one trial turned out to be not as successful as was expected.

Performance of Developers: The developers were not able to finalize a solid business case to finance the stations. They did however think through the plan and used appropriate methods for marketing and media attention.

4.4.12 Unsuccessful – Telehealth

Product Name: Telehealth



Description: These devices help people to measure their vital signs daily from home and transfer them to the responsible healthcare professional when necessary. Regular health assessments are conducted and can thereby recognise signs and symptoms of certain diseases, manage medication and side effects, and oversee diet and lifestyle. As a result, the pressure on the medical professional can decrease and they can focus on the critical cases.

Disruptiveness: These applications are disruptive because they decrease the responsibility of the healthcare professional and let the people do more themselves. Because part of the consult is automated, fewer cases will go through the doctor, as the computer already solves them. Additionally, the family members or

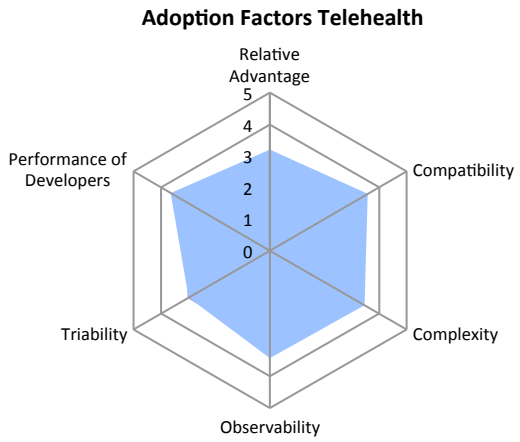
other carers have a better view on the status of the patient.

Development Process: For some years now, a division of Philips specialized in healthcare has been developing devices that people can use at home which gives them the opportunity to live longer independently. It seems however that it is very hard for them to really break through in the Dutch market (in the U.S. they are much more successful). Together with the Continua Health Alliance they now try to standardize these products more and more and continue to try and sell these products in The Netherlands (Telehealth, 2013; Hofstraat)

Users: Patients, carers

Involved actors: Patients, medical professionals

Score on Adoption Factors:



Relative Advantage: The relative advantage of telehealth devices is based on the user friendliness and independence that people acquire when using them. They no longer have to visit their GP regularly, only in case of a problem. They can also live independently for a longer period, relieving the pressure on and decreasing the costs of the nursing homes.

Compatibility: Due to the simplicity of most of the products, not much new knowledge needs to be developed. Processes do need to change on the side of the healthcare professionals, whom have to learn how to process the data efficiently. Furthermore, the concept fits quite well in the existing network structures.

Complexity: The products are not too complex for the users.

Observability: There is quite some general media attention for the concept of telehealth; almost everyone has heard of some of the possibilities. Experts are also relatively positive on the future of these devices.

Triability: These products were all carefully tested and certified before putting them in the market. There are probably testing centres for consumers and healthcare professionals to try-out products.

Performance of Developers: Philips, as a company, has shown much entrepreneurial talent before the launch of this concept. They used all sorts of media to bring these products under the attention of potential users.

4.4.13 Unsuccessful – TVfoon

Product Name: TVfoon

Description: The TVfoon is a telephone and video connection via a TV with all the other users of a TVfoon worldwide. It makes it easy for, for example, elderly to connect with their caregivers, family, or suppliers. The producers provide the users with specific television programmes that cover healthcare issues, living, wellbeing, work, and all other topics of importance.

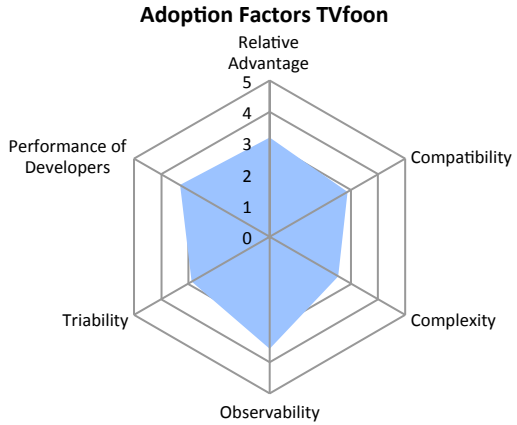
Disruptiveness: The TVfoon was a disruptive development because it used the simple technology of telephone with video and implementing it in the healthcare sector. By using the TV as medium, the access to the technology is very easy and for almost all easy to use. The spread of information is done automatically and it makes it easier for patients to be independent and make their own choices (Zorgvisie, 2007).

Development Process: In 2007, healthcare institutions Meavita, Sensire, Thuiszorg Groningen, and Vitras introduced the so-called TVfoon. The development of the product was done by an independent organization and financed by the home care institutes and indirectly by the users of the TVfoon. The high development costs would be compensated by the future sales, which were in retrospect too optimistic. In the end, Meavita went bankrupt and the complete project was cancelled (Skipr, 2013).

Users: Patients, carers

Involved actors: Patients, medical professionals, nursing homes, home care institutes,

Score on Adoption Factors:



Relative Advantage: The quality of the TVfoon lies in the user friendliness the large group of people that can make use of it. It enables elderly to be independent longer by enabling them to reach out to help and their needs by themselves.

Compatibility: The compatibility of the TVfoon was not so good. Various investments and efforts were necessary to install the TVfoons. For one, everyone needs to buy a device, because without it the concept does not work (alternatively there could have been a software solution). Second, all the other people such as suppliers, healthcare professionals, family members, etc., also needed to connect to TVfoon. However, the potential for standardization was in its concept rather high.

Complexity: The complexity of the product is generally not very

high. However, the users, elderly, do not have such a high absorptive capacity anymore, especially not when they become more and more dependent on their carers. This results in difficulties with convincing them to use the TVfoon.

Observability: There was large media attention for the TVfoon in both the healthcare sector and the social housing sector.

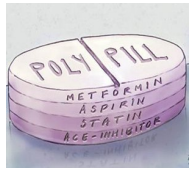
Triability: Before the product was introduced and installed, it is assumed that there were trials and prototypes had preceded.

Performance of Developers: The developers of the TVfoon used many forms of media and had the support of investors for installing it. They were however, in retrospect, maybe too optimistic about the outcome and made some mistakes in their prognoses.

4.4.14 Unsuccessful – Polypill

As an example for disruptive innovations in the pharmaceutical technology field, the case of the 'polypill' was used. This potential disruptive innovation was the only example found that could fit in this study. It was decided to not leave it out, because it could potentially show the difficulty for pharmaceutical innovations to be disruptive.

Product Name: Polypill – Four Component Combination Pill



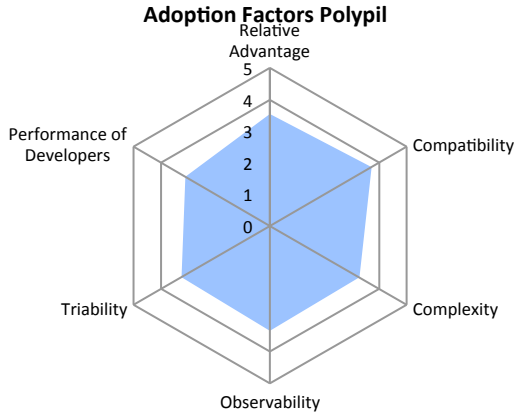
Description: Since 2003, researchers have been working on a so-called 'polypill'. It is a promising solution for patients with cardiovascular disease (CVD). This pill combines aspirin, statin, and anti-hypertensive drugs. Now, people with CVD use these medications separately, but combining them brings back four pills to one. Also, by using this standard pill as a precaution, the risks on cardiovascular diseases can drop significantly.

Disruptiveness: The polypill is a disruptive innovation because it simplifies the medication for people with CVD or for those whom are in the risk groups. On top of that, it has proven to be much cheaper, and it can be used in earlier stages in a way of prevention instead of treatment alone.

Development Process: Since 2003, researchers have been working on the polypill. They have been testing different variants that contained four to six different drugs with half of the dosage that normally is administered. Up until now, studies have shown that the efficacy of the polypill is positive, but it seems that the result are not as high as the sum of the parts. There are also more side effects than with the individual drugs separately prescribed (one out of every six people shows side effects). Thus far, the polypill has not been accepted or widely prescribed in The Netherlands. There is also still much criticism because medical professionals believe that the prescription of medication should always be customized (Hartstichting, 2011; Rodgers, et al., 2011). It should be noted that the Polypill is still in the trial phase, and it is therefore not unlikely that it will be successful in the near future.

Users: Patients (Cardio Vascular Diseases)

Involved Patients, potential patients, medical professionals,

actors:	healthcare insurers
Score on Adoption Factors:	

Relative Advantage:	The relative advantage of the polypill lies in the fact that it is very simple and easy to use. The group of users is potentially very high.
Compatibility:	As with most of the other disruptive innovation cases, the polypill has the potential to be standardized and fits well in the existing network structure.
Complexity:	The polypill does not seem to have more complex features than other pharmaceutical innovations. However, because it uses no new medication, not many adjustments at organization level need to be made.
Observability:	From different directions, there are multiple types of media attention for the polypill.
Triability:	The trial phases are carried out in the same manner as regular pharmaceutical innovations.
Performance of Developers:	Besides the increased attention from multiple actors in the Cardio Vascular Disease field, the developers follow the same processes as for the development of other medications.

4.5 Comparing the Cases

Below in table 9, the results of the case study analysis are summarized. The assumptions that can be drawn from these results are described below.

Table 9: Results of the Case Analysis

		MedTech						ICT							Pharma
		Successful			Unsuccessful			Successful				Unsuccessful			Unsuccessful
Indicator:		Angioplasty	Home pregnancy test	ZBC's	Mammaprint	All-in-one Diabetes devices	Mobile Ultrasound	Buurtzorg	E-prescriptions	Zorgdomein	Trees	DiabetesStation	Telehealth	TVfoon	Polypill
Relative Advantage	Performance in quality	0	0	+	+	+	0	0	+	+	+	+	0	0	0
	User friendliness	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	Time for implementation	0	0	+	0	0	0	0	0	0	+	+	0	0	0
	Scope of illness	+	+	0	0	+	0	0	+	+	0	+	+	+	+
	Severity of illness	0	-	0	+	0	0	0	0	0	0	0	0	0	0
	Adverse outcome if not used	0	-	-	+	0	-	0	0	-	0	0	0	-	0
Compatibility	Capital required	0	+	+	0	+	+	0	0	0	0	+	0	-	0
	Time required	+	0	+	-	+	+	0	0	0	0	+	0	0	0
	Extend of management change	-	0	0	0	0	0	+	-	+	+	0	0	0	0
	New tacit knowledge development	0	+	+	+	0	0	0	-	+	+	+	+	0	0
	Number of adjustments necessary	0	+	+	+	+	+	0	0	0	0	0	0	-	0
	Fits type of evidence required by users	+	+	+	0	0	0	+	+	+	+	0	0	-	0
	Conflict with social or cultural morals	+	0	+	+	+	+	+	+	+	+	+	+	0	0
	Fits in existing network structure	+	+	0	+	+	+	+	0	+	+	0	+	0	+
	Social costs	+	+	+	0	+	0	+	0	0	+	+	0	0	0
	Possibility for standardization	+	+	+	+	+	+	+	+	+	+	+	+	+	+

Complexity	Absorptive capacity of users	0	0	0	0	0	0	**0**	**+**	**+**	**0**	**0**	**0**	**-**	0
	Change capacity of users	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Type of evidence appropriate to the complexity	**+**	**+**	**+**	**0**	**0**	**0**	**+**	**+**	**+**	**+**	**0**	**0**	**0**	0
	Number or adjustments	0	0	+	0	0	+	0	0	0	+	0	0	0	+
	Number of involved actors	0	0	0	0	0	0	0	0	-	0	0	0	0	0
	Easiness of mimicry	0	-	0	+	0	0	0	-	0	0	-	+	-	-
	Complexity fits education level	0	+	+	0	0	0	0	+	0	+	0	+	0	+
Observability	Trials in similar, visible context	0	0	+	0	+	0	0	+	+	0	0	0	0	0
	Media attention	0	+	+	+	+	0	0	+	0	0	0	0	+	0
	Positive experts' opinions	**+**	**+**	**+**	**0**	**0**	**0**	**+**	**+**	**+**	**+**	**0**	**0**	**0**	**0**
Triability	Number of prototypes	0	0	0	0	0	0	0	0	0	0	-	0	0	0
	Extend of niches or pilots	0	0	0	0	0	0	0	0	0	0	-	0	0	0
Performance of developers	Readiness for market	0	0	+	+	0	+	0	0	0	+	0	+	+	0
	Use of media (popular, well-defined)	0	+	+	0	0	0	0	+	0	0	0	0	0	0
	Entrepreneurial talent	*	0	0	0	*	+	*	*	0	+	-	+	-	0
	Time spend on promotion	0	0	0	0	*	*	*	*	0	0	0	0	0	0
	Fit of marketing strategy to the sector	0	+	+	0	0	0	0	+	0	0	0	0	0	0

From the surveys, it became apparent that many of the indicators as defined by Rogers are not directly influencing the success or failure of a disruptive innovation. All in all, most cases score 'average' or 'good' on most of the indicators. This is probably caused by the fact that the healthcare sector has strict regulations that need to be adhered when introducing a product. All the cases did therefore use, for instance, prototypes and performed pilot studies before entering the market. Some indicators scored generally very high. Especially the indicators 'performance in quality' and 'user friendliness' are suiting the sector. Additionally, the nature of disruptive innovations result in overall high scores on the indicators for 'conflict with social or cultural morals', 'fit in the existing network structure', and 'the possibility for standardization'. This is because most cases do not use new technology or procedures, making the acceptance of the innovation much easier. The 'possibility for standardization' is closely linked to the indicator 'easiness of mimicry', which is almost half of the cases quite high. The question arises whether this is a problem for the adoption of an innovation in the first place. Anyhow, the outcome of this study showed that the adoption indicators as defined by Rogers are not exclusive for success. As the theoretical framework predicted, innovations are also dependent on the context.

Nonetheless, from the surveys two significant indicators seemed to contribute to the failure of adoption. These were 'fits type of evidence required by users' and the 'positive experts' opinion'. Apparently, the unsuccessful cases were not as capable of proving their added value to the (entire) group of users as compared to the successful cases. Most failed cases scored 'neither positive or negative for adoption' (average), but the successful cases all scored 'positive for adoption'. The 'positive

expert's opinion' seems to be rather significant as well. This is closely related to the 'type of evidence', because when the evidence is not entirely appropriate for the sector, it will automatically result in less support from experts. Or, the other way around, the support from experts can be crucial evidence that supports the product.

In the ICT technology field, the complexity of a product can cause significant problems for the adoption of an innovation. For one, it seems that the higher the 'absorptive capacity' of users is, successful adoption is more likely. Subsequently, the higher the complexity of an ICT innovation, the more important it is that the type of evidence is fit to the often broad spectrum of users. For now, it seems that the successful ICT innovations are focused on the healthcare professionals or the carers. The products that thus far failed were focused on patients. The last group is far more diverse and harder to teach new methods.

The Polypill seems to follow the same procedures as all other medication trials and development processes. Hence, it did not have many outstanding scores in this survey. This makes it hard for a disruptive innovation in pharmaceutical sector to enter the market or in that case, be any different from 'normal' innovations. In the case of the disruptive pharmaceutical innovations, there is always a better and more advanced alternative that is preferred by the medical professionals.

4.6 Relating Cases and Context Factors

Below in table 10, the cases are put across the factors abstracted from the context analysis. Outstanding results are highlighted.

Table 10: Cases and Context Factors Analysed

		MedTech						ICT							Pharma
		Successful			Unsuccessful			Successful				Unsuccessful			Unsuccessful
Factors:		Angioplasty	Home pregnancy test	ZBC's	Mammaprint	All-in-one Diabetes devices	Mobile Ultrasound	Buurtzorg	E-prescriptions	Zorgdomein	Trees	DiabetesSration	Telehealth	TVfoon	Polypill
Application Domain	1. Specification of actions per type of user	+	*	*	-	+	*	+	+	+	+	+	*	*	*
	2. Personal contact with users	+	-	+	*	*	*	+	*	*	+	*	-	+	*
	3. Education of users	+	-	-	-	+	*	*	*	*	+	+	*	*	+
	4. Patience and resources	+	+	+	+	+	+	+	+	+	+	-	+	-	+
Culture	5. Knowledge of cultural traditions	+	+	+	*	+	+	+	+	+	+	+	+	+	+
	6. Status	+	*	+	+	+	*	*	*	+	+	+	+	-	+
	7. Support from large actors	*	*	-	-	+	+	-	+	-	+	+	+	+	+
Networks and Infrastructure	8. Knowledge of the network	+	+	+	+	+	+	+	+	+	+	+	+	*	+
	9. Collaboration	*	*	-	-	-	+	-	+	*	+	+	+	+	+
	10. Spread of knowledge	+	+	+	+	+	+	+	*	+	+	+	+	+	+
	11. Adhere to rules of conduct	+	+	+	-	+	+	+	+	+	+	-	+	+	+
Politics	12. Knowledge of regulations	+	+	+	-	*	*	*	+	+	+	-	+	*	+
	13. Preparation for policy changes	*	+	+	*	*	*	+	*	+	+	-	*	-	+
	14. Independence from subsidies	+	+	+	+	+	+	*	+	+	+	-	-	-	-
Technology	15. Technology on demand/market pull	-	-	-	*	+	-	+	+	+	+	+	-	-	-
	16. Standardization	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	17. Return on Investments	*	+	+	+	*	*	*	+	+	*	-	*	-	+
Scientific Knowledge	18. Careful use of sensitive information	*	+	+	+	+	+	*	+	*	*	*	+	*	+
	19. Fit to education level of users	+	+	+	*	+	*	+	+	+	+	+	+	*	+
	20. Patents	*	-	*	+	*	+	*	*	*	*	*	*	*	*

From the consideration of context and adoption factors, no specific factor could be identified that caused failure of all the unsuccessful disruptive innovations. However, two factors were only missing in unsuccessful cases. These were the factors 'knowledge of regulations' and 'adherence to the rules of conduct'. There are many decision makers and market bodies that all can prevent the adoption of an innovation. It is hence very important that producers are aware of all the rules and regulations for the adoption of an innovation. Thereto related is the knowledge of 'how things are done' (the rules of conduct). An innovation is at disadvantage to be adopted when the producers do not follow these procedures or try to do it different from 'how it is done'.

The examined cases in this study mostly performed well on the 'specification of actions per type of user', 'knowledge of cultural traditions', 'status', 'knowledge of the network', 'spread of the knowledge', 'standardization', and 'fit to the education level of the users'. Most producers apparently handle towards these automatically. It can thus not be determined whether these factors are crucial for the successful adoption process of disruptive innovations. Additionally, it appears that collaboration with either users or knowledge institutes is not a required success factor for the introduction of new products.

There are also noticeable differences between the different technology areas. In the medical technology field, all cases showed to have 'patience and resources' and were 'independent from subsidies'. Therefore, nothing can be said on the significance of those factors. Subsequently, to be successful, it does not seem to matter, at least in these cases, whether the producers have 'personal contact' with the users, 'educated the users', have 'patented' their technology, or did not develop their 'technology on demand'. These factors are somewhat related as with technology push producers are not likely to have much interaction with the end-users from the start.

In the ICT technology area, more factors showed that, when not adhered to, they influence the failure or success of an innovation. First, all three failed cases were 'dependent on some form of subsidy'. One might ask whether subsidies are the cause or an effect of (potential) failure. In other words, when subsidies are granted, are innovations doomed to fail, or are only potential unsuccessful innovations eligible for a subsidy? One of the experts stated that an innovation should always be backed by a solid business plan and able to generate its own return on investment (ROI). If not, the innovation is destined to be unsuccessful (Wittop Koning). This is also interrelated to the shortcomings of these unsuccessful cases at the factor 'ROI' and lack of 'patience and resources'. Two of the ICT innovations (TVfoon and DiabetesStation) failed because the resources were not extensive enough to last through the acceptation phases and the products were not able to generate their own return on investment to continue market presence[†]. A fourth factor that was not carried out well enough was the 'preparation for policy changes'. Perhaps, both the DiabetesStation and TVfoon assumed that policy changes in financial compensations would aid their cause in the future. And last but not least, it seems that two of the failed cases originate from a technology push approach, which apparently does not work in this technology area.

Remarkable is that the failed cases all had support from large actors such as academic hospitals, innovative companies, and other healthcare institutes. Even though the context analysis revealed that the support of large actors is a stimulating factor for success, this does not prove to be pivotal and maybe even counteracting in the example cases.

[†] Even though this did not show as a significant factor in the medical technology field, ROI is assumed to be of importance for the existence and continuous market presence of medical technologies.

4.7 Implications for Theory and Evaluation of Conceptual Model

The results from the case study analysis implied that the adoption indicators as defined by Rogers are not exclusive in determining successful adoption of disruptive innovations. Hence, the context also seems to have influence on this. Christensen depicted that regulators, medical specialists, insurance companies, and hospitals are the main obstacles for disruptive innovations to find their way in the healthcare sector (Christensen et al., 2000; Christensen et al., 2009). This study found that the medical professionals (the experts) certainly have a large influence on the adoption of innovations. In the first place, they are often the users and thus make the adoption decisions, and in the second place, their support results in the reimbursement from healthcare insurers and approval from regulatory bodies. The regulatory bodies do also have an influence on the adoption of innovations, but their 'authority' is mostly limited to the opinion of the medical professionals or experts. They would not risk the safety of patients if medical professionals do not collectively support a technology. Moreover, in the case of ICT technology, when no financial reimbursement is required, there are only market bodies that, for example, prove safety of the devices or software systems. Then again, the users decide whether a new technology is accepted. Yet, as was mentioned in the context analysis, when patients are the end-users, the medical professional acts as an 'ambassador' of new technology and is a key aspect in the adoption decision of patients. In other words, the influence of the medical professional is extended to patients.

It was not determined that hospitals or large healthcare institutes are preventing the adoption of disruptive innovations in this study. They do have existing investments that might make them less likely to consider new solutions, but they were also initiating parties in some of the failed cases. Relatedly, the medical professionals still have a large influence on the innovative decisions of hospitals. In the future, this influence will probably decrease, because less medical professionals will be associated with a hospital via an independent partnership.

The Dutch insurance companies do have an influence on the acceptance of new technology, because in many cases, they only compensate for approved medical techniques. In the ICT technology sector, their influence is hence much lower, because many of those disruptive innovations do not require compensation by insurance companies. Essentially, an insurer stands in the position to stimulate the adoption of disruptive innovations; for example, by putting pressure on hospitals and healthcare institutes to search for cheaper solutions to lower the costs. This would be very positive for the adoption of disruptive innovations. Whether they use that position is not a given.

So, are there any differences between 'normal' innovations and disruptive innovations in the adoption process? Many of the adoption indicators and context factors in this study could also account for 'normal' innovations (innovations that do not cause a shift in users, price, or responsibilities). However, assumed is that the (personal) interest of the medical professional influences the adoption of an innovation. Hence, when an innovation causes the medical professional to 'loose their tasks' to lower educated medical professionals or even patients, this might not lead to easy acceptance; it gives them at least one more factor to consider. Furthermore, because disruptive innovations aim for new users, the complexity of the innovation and the lower absorptive capacity can cause, more often, limitations for adoption. Subsequent is the technology on demand (market pull), which is also more significant for the success of a disruptive innovation.

Looking in retrospect to the conceptual model, various points can be concluded. Firstly, the case analysis showed that from the adoption indicators, the 'complexity', 'compatibility', and 'observability' seem to have crucial indicators for successful adoption. This does however not

mean that the other indicators are of less importance; the reviewed cases showed overall a high score on most of the indicators. Nonetheless, the adoption factors and their indicators are not exclusively responsible for the adoption of disruptive innovations. Accordingly, as was also concluded from the theory, the context does have an influence. From the consideration of cases in the context, it seems that especially the 'Application domain', 'Networks', and 'Politics' have an effect on the successful adoption of disruptive innovations. Again, this does not discard the importance of the other regime pillar indicators. All in all, the analysis showed that the context is of influence on the adoption factors at different levels. This relation is however more conditional. For example, the application domain is conditional to the compatibility and complexity of an innovation. The same accounts for the culture, networks, and politics in the sector, they all set conditions for the individual adoption decision of users. The developers of disruptive innovations can affect the development of a product in such a way that context and adoption factors are met to optimize the diffusion chances. Altogether, the factors determine whether the diffusion of a disruptive innovation will occur successfully. See figure 7 for the revised conceptual.

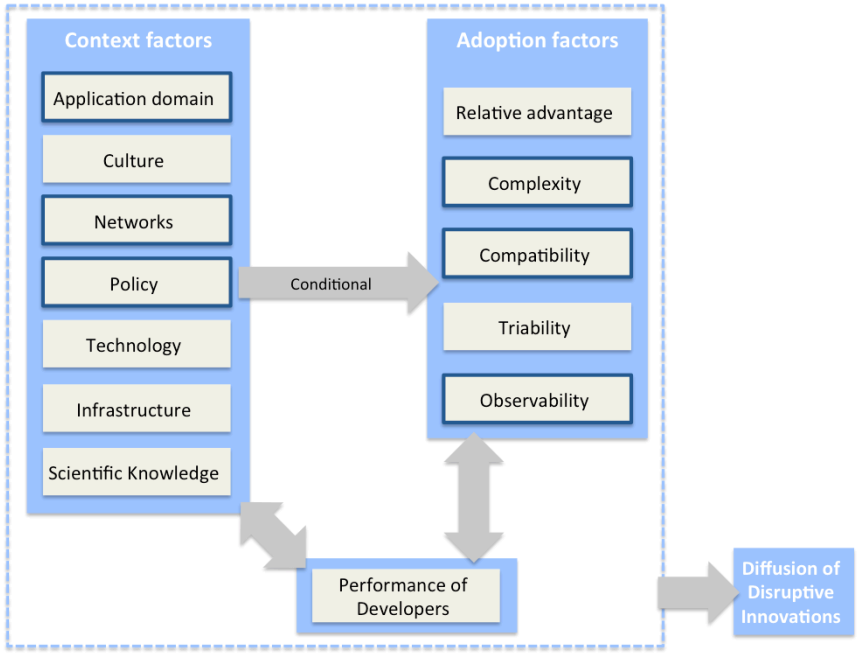


Figure 7: Conceptual Model: Diffusion of Disruptive Innovations Revised

5. Conclusions

To answer the research question of this study, the significant actors of the Dutch healthcare sector were first identified. In the large overview in figure 6, all the involved actors are shown. However, the most influential actors are first the medical professionals and, to somewhat lesser extent, the patients as users of the innovations, and second, the CVZ and healthcare insurers respectively approving and providing financial compensation. Regulatory bodies and healthcare institutes do not seem to be as significant as Christensen et al. (2000 and 2009) depicted. This means that when there is no consensus of the medical professionals about the quality or efficacy of a product, it results in no financial compensation and hence in failed diffusion.

Subsequently, seven successful and (up to now) six unsuccessful cases were selected in the medical technology and ICT fields. Generally, it seems that there are much more examples of disruptive ICT innovations than in the other technology fields. One explanation for this can be the nature of ICT systems; through standardization and automation, they replace responsibilities and have thereby more often a disruptive character. Unfortunately, in the nutritech and pharmaceutical sectors, no examples of successful disruptive innovations were found. As an example, one hitherto unsuccessful disruptive innovation was selected from the pharmaceutical technology field as fourteenth case in the analysis.

To find the stimulating and thwarting factors for the adoption of the disruptive innovations in the Dutch healthcare sector, the case study analysis was conducted. It gave insight in the adoption factors that are significant for the success or failure of disruptive innovations. For all cases, it is important that the evidence that is required by users and a positive experts' opinion is provided. In the ICT technology field, also the absorptive capacity of users was found to be a thwarting factor for adoption. However, most of the cases showed relatively positive scores on all other adoption indicators. This meant that, as the theoretical framework suggested, Rogers' adoption indicators are not exclusive in adoption of innovations and a context analysis was therefore required.

Interviews were held and yielded the information on the context factors. From the analysis, twenty specific factors were identified that are of importance for adoption of innovations. By considering these factors against all the cases, the 'knowledge of regulations' and the 'adherence to the rules of conduct' seem to be of importance for the successful adoption of a disruptive innovation as well. Additionally, in the ICT technology field, an insufficient amount of (financial) resources, dependence on policy changes, technology push development, and dependence on subsidies or other financial support are all potentially thwarting for the diffusion of a disruptive innovation. All in all, besides the conditions the context sets for the adoption factors, it generates significant factors for the diffusion of innovations that developers need to perform as well.

When there finally is an increased diffusion of disruptive innovations in Dutch healthcare, it might result in a more efficient and relatively cheaper healthcare system. To increase the number of successfully diffused disruptive innovations in the Dutch healthcare sector however, there are several steps to be taken. For one, the developers of potential disruptive innovations need to ensure that they provide the medical professionals and/or users with the required evidence of added value. Part of that evidence is also the positive experts' opinions. Developers also need to follow the rules, know the regulations and rules of conduct in that sector, and, in the case of ICT technology, meet the factors mentioned above.

On the other side, changes of cultural aspects in the entire network could also benefit the adoption and diffusion of disruptive innovations. For instance, an increased focus on the efficiency of an innovation instead of

on quality or efficacy would lead to more approvals from for CVZ for disruptive innovations. Safety of patients should not be discarded, but less 'decision power' with the same group of people (medical professionals) would hopefully result in more differentiation of innovations. Such job could, for example, go to an autonomous market body. Another solution could be more market oriented, where only patient safety is checked and all other adoption decisions are left for users via healthcare insurers. Important in any solution is that no single actor should have an overall control on the adoption of innovations.

6. Discussion

Alas, this research included some limitations. Some of these were caused by the chosen scope and research methods; others were encountered during and after the analyses and drawing of conclusions.

To start, for the selection and differentiation of the successful and unsuccessful cases, there was always an influence of time and relativity. Over time, the level of success can change. This meant that at one point, a product could be diffused successfully throughout the sector, but a couple of years later this can be different. To be able to compare cases in this study, the level of diffusion of this point in time, the year 2013, was used as reference point. This does however not rule out the possibility of success or failure in the future. The second point was that success is relative. Is a product successful when it is diffused for 100%, and is 100% over all people, or simple a select group of potential users? In the case of the Mammaprint, the users would only be women who recently had surgical removal of a breast tumour. In this study, the cases were determined as successful when they either received reimbursement by healthcare insurers, or when they are for sale and used by patients or medical professionals (mostly in the case of ICT technologies). This remains however a point of discussion and in another time, place, or sector they could generate different results.

For the data collection, this research design required a great deal of specific data; unfortunately, not all information on the cases was available or obtainable. These were, for example, related to the indicators 'capital required', 'social costs', 'entrepreneurial talent', and 'time spend on promotion/marketing'. Additional research and interviews with multiple actors would have given more insight on the exact performance and actions of developers for each case. In the set time frame, the opportunities for that level of extensiveness were limited. For the context indicators, the breadth of the scope and sector resulted sometimes in very broad answers with many nuances. This is visible in the definition of 'users'. Users range from patients to healthcare institutes, and everything and anyone in between. Nonetheless, the quality of the collected data was remained as high as possible by using four participants per case survey, extensive and additional literature study, and five interviewees from different perspectives and backgrounds. By providing grounded argumentation and elaboration for the operationalization, and by making the survey and interview questions as understandable and as unambiguous as possible, it was aimed to maximize the reliability of this study. Moreover, for the context indicators, elaboration on and differentiation in answers was encouraged. In the case of unobtainable data, this was clearly stated in the data overviews.

During the research process, it became apparent that the level of selected cases was sometimes different; some cases were more at concept level, others at product level. There was also a difference in development process phase; some, such as the home pregnancy test, were completely diffused throughout the system, others were still in pre-market phases when entering the market. It was therefore difficult at some times to use the same set of survey questions for the different types of cases. Further explanation of the indicators to the interviewees or the participants of the surveys solved this in most of the occasions and kept the differences at a minimum.

Another point in the data analysis was the use of the Likert Scale. The chosen method to represent potential differences had the prospect to show significant differences between cases. However, it also gave many average scores, making it hard to draw solid conclusions.

The nature of a case study analysis makes that the conclusions are limited to the selected cases. Despite the multiple cases in different technology areas, the number is still too small to generalize results over the whole

healthcare sector. This could be solved by further research to more cases and comparisons with, for instance, other sectors or types of innovations.

The distinction between disruptive innovations and 'regular' innovations was also difficult to confirm. For now, assumptions based on the theoretical framework could answer these questions provisionally. In further research, this could be solved by including 'regular' innovations in the case selection and compare their scores to disruptive innovations.

For all the points of discussion mentioned above, further and more elaborate research could provide answers and information. Then conclusions that are more precise and subsequently advice for the sector could be formulated.

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8. Appendix A – Adoption Indicators

In table 11 an overview of all the selected indicators from the theory are shown. First, all these indicators were written down directly from the theory articles. Then, they were categorized according to the dimensions of the MLP and Rogers' adoption factors.

Table 11: Adoption Indicators in the Dutch Healthcare sector based on Rogers (1983), Wejnert (2002) and Fitzgerald et al. (2002)

Main Indicators of adoption	Specific indicators	Dimension	Explanation
Relative advantage	Performance in quality, Performance in user friendliness, Capital required, Performance in time, Belief of users (caregivers) in applicability, Number of patients with illness (applicability scope), Severity of illness, Availability of technology, Outcome if not used, Organizational boundaries	Application domain (Technology) (Infrastructure)	How a product performs as opposed to the alternative solutions. The better this performance is, the higher the relative advantage, which has a positive effect on the adoption of an innovation. Caregivers will be more easily persuaded when patient compliance is high and the willingness of the caregiver is good.
Compatibility	Direct costs: - Patents - Legislative - (Research) investments Indirect costs: - Time - Management - Tacit knowledge - Number of adjustments necessary - Costs of change - Costs of restructuring - Social costs Possibility for uniformity Possibility for institutionalization Easiness of mimicry Absorptive capacity of users	Application domain Technology Infrastructure	The level of compatibility that an innovation into an individual's life costs. The higher de compatibility, the more likely adoption will occur. Possibilities to uniformity; are there many adjustments necessary? Costs are equal to risk; when higher than actor's resources, no adoption) Indirect costs; the higher, the harder adoption Absorptive capacity; level of education of users (are they capable of and willing to learning new methods), and education availability
Complexity	Absorptive capacity of users, Change capacity of users, Nature of scientific	Application domain Technology	How easy an individual is able to learn to work with a new technology. The lower the complexity and the higher the knowledge background, the easier

	knowledge necessary for using innovation, Number and scope of adjustments necessary, Amount of involved actors, Diffusion across boundaries	Scientific knowledge Infrastructure	adoption will occur.
Triability	Number of prototypes, Extend of niches	Technological niche Culture	The easier one can experiment, the sooner they will adopt.
Observability	Trials in similar context (visible for users), Media attention Positive experts' opinion Type of evidence required by users	Application domain Scientific knowledge Networks Culture	The greater the visibility of an innovation, the easier knowledge will spread and the sooner adoption will occur. Type of evidence; objective or familiar from network, specific or general
Political Context	Number of political actors Stability of context Threat of disease Time Actors defining guidelines Bureaucratic efficiency Protection of domestic or existing technologies Governmental support	Policy	Higher stability, high threat of disease, short treatment time, high bureaucratic efficiency, no protection of existing technologies and governmental support all have a positive influence on the adoption process.
Cultural Context	Sensitivity to outside influence Conference to status (adoption of prominent members) Degree of cultural traditionalism Degree of cultural homogeneity The wish to be the best Conflict with social or cultural morals Fit of the structure of existing networks	Culture	When there is a high sensitivity to outside influence, little traditionalism, high cultural homogeneity, many aspirations of actors, no conflicts on fundamental morals, and an easy fit in the existing structure, the adoption process will go easier.
Network Context	Nature of relations Type of relations (centralized/decentralized, stratified/unstratified, homogeneity/heterogeneity) Strength of relations (closeness) Number of friends/advisees Credibility (objective or from relations) Openness to information	Networks	The density, openness, frequency of contact and familiarity all have a positive effect on the adoption of innovations when scoring high.

	Openness of communication Frequency of interaction Proximity of actors Authority level Density of actors Familiarity among CEO's Level of coercion Relative level of innovation-relevant knowledge		
Performance of developers	Readiness for market (phase in innovation process) Involvement Use of media Socialization Talents of entrepreneurship Perseverance Determination Marketing skills Proficiency	Technological niche	An area in which prototypes of disruptive innovations can be tested. When these indicators are executed well, the chance of adoption is higher.

9. Appendix B – Interviews

Table 12: Overview of Interviewees			
Name	**Organization**	**Date of interview**	**Function and Expertise area**
Michel van Schaik	Rabobank	13-05-2013	Director Healthcare Rabobank – expertise in the Dutch healthcare sector in general
Kim Egger	LageLanden	08-05-2013 and 13-05-2013	Commercial Director, Healthcare Europe at Lagelanden – expert in the medical technology sector
Marc Koolen	GlaxoSmithKline	14-05-2013	Head Care Innovation at GSK – expert in the pharmaceutical technology sector
Hans Hofstraat	Philips	17-05-2013	Vice-President Philips Healthcare – expert in medical technology sector
Maarten Wittop Koning	KPN	28-05-2013	Directeur E-zorg B.V. (part of KPN) – Expert in ICT and e-Health

Interviews were all held in Dutch, therefore, the questions of the interviews were also set up in Dutch. Translation to English can always be send, when translation is required.

INTERVIEW QUESTIONS EXPERTS WITHIN DUTCH HEALTHCARE		
Nr.	**Question**	**Answer**
Application domain		
1a.	Staat deze sector open voor nieuwe applicaties en technologieën?	Niet - Weinig - Af en toe - Meestal - Altijd
1b.	Hoe komt dit?	
2a.	Heeft de omvang van de patiëntengroep invloed op de acceptatie van innovaties?	Niet - Weinig - Af en toe - Meestal - Altijd
2b.	Waarom wel of niet?	
3a.	Heeft de ernst van een ziekte invloed op de acceptatie van nieuwe technologieën?	Niet - Weinig - Af en toe - Meestal - Altijd
3b.	Waarom wel of niet?	
4.	Hoe lang duurt de gemiddelde implementatie van een nieuwe technologie in deze sector?	Nominaal
Culture		
5a.	Zijn mensen binnen deze sector gevoelig voor extern advies?	Niet - Weinig - Af en toe - Meestal - Altijd
5b.	Hoe komt dit?	
6a.	Hoe belangrijk is status? (maatschappelijk aanzien of titels)	Niet - Weinig - Af en toe - Meestal - Altijd
6b.	Hoe komt dit?	
7a.	Is prestige een belangrijke factor? (door bijvoorbeeld het produceren van bepaalde producten of track-record)	Niet - Een beetje - Gewoon - Best wel – Heel erg
7b.	Hoe werkt dit?	
7c.	Wat zijn hier de resultaten van?	
8a.	Heerst er in deze sector een hoge mate van culturele tradities?	Geen - Een beetje – Gewoon - Best wel - Sterk
8b.	Hoe uit zich dat?	
8c.	Waar merkt u dit?	
9a.	Heerst er in deze sector een hoge mate van culturele homogeniteit? (verschillen met concurrenten, nationaal en internationaal)	Geen – Een beetje – Gewoon – Best wel – Sterk
9b.	Hoe uit zich dat?	
10.	Wat voor bewijs vereisen de	Nominaal

	gebruikers van nieuwe technologieën?	
11a.	Zijn prototypen nodig om een innovatie succesvol te laten zijn?	Niet - Weinig - Af en toe - Meestal - Altijd
11b.	Waarom wel of niet?	
11c.	Hoeveel prototypen en wat voor soort prototypen zijn er vereist?	
12a.	In hoeverre bestaan er niches of pilot studies voor een innovatie de markt betreedt?	Niet - Weinig - Af en toe - Meestal - Altijd
12b.	Hoe belangrijk zijn deze niches of pilots?	Niet - Een beetje - Af en toe - Best wel - Heel erg
Networks		
13.	Welke voor soorten relaties zijn gebruikelijk in deze sector?	
14.	Uit welke partijen bestaan netwerken binnen deze sector?	
15.	Wat is de aard van deze relaties en netwerken?	
16.	Hoe sterk of persoonlijk zijn deze relaties in het algemeen?	Helemaal niet – Niet echt – Een beetje – Behoorlijk – Heel erg
17.	Hoeveel partijen of personen zijn er gemiddeld betrokken bij de lancering van een nieuw product?	
18a.	Welke geloofwaardigheid (credentials) heeft iemand of een bedrijf nodig om geaccepteerd te worden?	
18b.	(Wat heeft een partij nodig om geaccepteerd te worden?)	
18c.	Waarom?	
19.	Is informatie open verkrijgbaar?	Niet - Weinig - Af en toe - Meestal - Altijd
20.	Zijn communicatiekanalen open?	Niet - Weinig - Af en toe - Meestal - Altijd
21.	Hoeveel interacties zijn er per relatie?	Eens per jaar – eens per maand – eens per week – dagelijks – …
22.	Hoe belangrijk is autoriteit?	Niet - Weinig - Af en toe - Meestal - Altijd
22.	Welk niveau van autoriteit is nodig voor een succesvolle realisatie van een innovatie?	
23.	Zijn er veel verschillende partijen binnen deze markt? M.a.w. is de dichtheid hoog?	Niet - Een beetje - Gewoon - Best wel – Heel erg
24.	Zijn er persoonlijke contacten tussen de CEO's van de bedrijven in deze sectoren?	
25.	Zijn er wel eens dwangmaatregelingen?	Nooit - Heel soms - Soms - Vaak - Altijd
26.	Is de innovatie-gerelateerde kennis hoog binnen de netwerken?	Niet - Weinig - Af en toe - Meestal - Altijd
Politics		
27a.	Hoeveel politieke actoren zijn er in deze sector?	Number
27b.	Wie zijn dit?	
27c.	Wie zijn hier de belangrijkste of hebben de meeste invloed?	
28a.	Wie bepalen in deze sector de regels en richtlijnen?	
28b.	Welke partijen hebben hier invloed op?	
29.	Hoe stabiel is deze politieke situatie?	Niet – Niet echt – Redelijk – Best wel - Heel erg
30.	Heeft de ernst van een ziekte invloed op de beleidsvorming?	Niet – Niet echt – Redelijk – Best wel – Heel erg
31.	Hoe lang doet de politiek er in deze sector over om veranderingen door te voeren?	Heel lang – lang – normaal – kort – heel kort
32a.	In hoeverre speelt bureaucratie een	Niet – Niet echt – Redelijk – Best

	belemmerende rol?	wel – Heel erg
32b.	Hoe uit zich dit?	
33a.	Is er enige vorm van bescherming voor nationale of bestaande technologie?	Ja/nee
33b.	Zo ja, hoe?	
34a.	Is er ondersteuning vanuit de overheid bijvoorbeeld in de vorm van subsidies voor de ontwikkeling van nieuwe technologie?	Ja/nee
34b.	Zo ja, kunt u voorbeelden geven?	
34c.	Helpt dit?	
34d.	Zo nee, zou dit wel helpen?	
Technology		
35a.	Is er vaak nieuwe technologie beschikbaar?	Nooit - Heel soms - Soms - Vaak – Heel vaak
35b.	Is de technologie de gebruikt wordt in deze sector complex?	
36a.	Hoe hoog zijn de research investeringen?	
36b.	Hoe hoog is dit vergeleken met andere sectoren?	Laag – Iets minder – Gelijk – Iets hoger – Hoog
37a.	Hoe vaak komt uniformiteit voor in deze sector?	Nooit - Heel soms - Soms - Vaak – Heel vaak
37b.	Wordt er op de juiste manier gebruik van gemaakt?	Nooit – Heel soms – Soms – Vaak – Heel vaak
37c.	Is er de mogelijkheid om uniformiteit te verbeteren of vaker toe te passen?	Ja/nee
37d.	Kunt u voorbeelden geven?	
37e.	Zo nee, hoe komt dit?	
38.	In hoeverre komt institutionalisering voor?	Nooit - Heel soms - Soms - Vaak – Heel vaak
39a.	Zijn mensen of bedrijven op zoek naar imitaties?	Nooit - Heel soms - Soms - Vaak – Heel vaak
39b.	Zijn deze succesvol?	Ja/nee
Infrastructure		
40a.	Zijn er veel professionele grenzen of belemmeringen? (*Hiermee worden grenzen bedoeld die (gedrags)regels stellen of een takenpakket aangeven tussen professionals onderling of met cliënten)	Geen – bijna geen – een paar – best wel wat – heel veel
40b.	Voorbeeld?	
41a.	Zijn er veel organisatorische grenzen of belemmeringen?	Geen – bijna geen – een paar – best wel wat – heel veel
41b.	Voorbeeld?	
42a.	Komt diffusie over professionele grenzen vaak voor?	Nooit - Heel soms - Soms - Vaak – Heel vaak
42b.	Voorbeeld?	
43a.	Komt diffusie over organisatorische grenzen vaak voor?	Nooit - Heel soms - Soms - Vaak – Heel vaak
43b.	Voorbeeld?	
44a.	Hoe groot is het belang van bestaande investeringen	Laag – vrij laag – gemiddeld – vrij hoog – Hoog
44b.	Hoe uit zich dit?	
Scientific Knowledge		
45a.	Is wetenschappelijke kennis gemakkelijk te verkrijgen in deze sector?	Niet – Niet echt – Redelijk – Best wel - Heel erg
45b.	Hoe uit zich dat?	
46a.	Is de wetenschappelijke basis van deze sector complex?	Niet – Niet echt – Redelijk – Best wel - Heel erg
46b.	Hoe uit zich dat?	
47a.	Wat is het gemiddelde opleidingsniveau van de gebruikers van technologie in deze sector?	Laag – middel – Hoog – universitair – universitair +
47b.	Is dit van belang?	
Disruptive Innovations		

48.	Weet u wat disruptive innovations zijn?	
49.	Kent u binnen uw sector voorbeelden van succesvolle disruptive innovations?	
50.	Kent u binnen uw sector voorbeelden van mislukte disruptive innovations?	

10. Appendix C – Results Interviews

Interview Michel van Schaik on Dutch Healthcare 13-05-2013	
Nr.	**Answer**
1a.	Niet - Weinig - **Af en toe** - Meestal - Altijd
1b.	Patiënten verschillen per leeftijdscategorie: ouderen verwachten vaker persoonlijk contact en dat dingen gaan op de manier hoe het altijd gegaan is; jongeren staan veel meer open voor nieuwe vormen van communicatie, technologieën e.d. Professionals zijn vaak heel conservatief. Als het gaat om medische technologieën staan ze vaak wel open om hier cursussen voor te volgen en nieuwe apparaten uit te proberen (dit zie je in het aantal nieuwe grote apparaten); als het gaat om sociale innovaties in het omgaan met patiënten zijn ze juist heel terughoudend om daar in 'door te ontwikkelen'. Hier lijkt onzekerheid en het eigen kunnen de beperking is.
2a.	Niet - Weinig - **Af en toe** - Meestal - Altijd
2b.	Uiteindelijk wel, als de impact zo groot kan zijn, zullen er zeker maatregelen genomen worden. Desalniettemin zijn dokters vaker geneigd om te denken in termen van de 'volgende patiënt'. Dus als er meer patiënten komen, zullen ze eerder geneigd zijn harder te gaan werken, i.p.v. nadenken over een andere aanpak. Een nieuwe (disruptive) oplossing komt dan ook vaak niet uit eigen initiatief, maar van buitenaf.
3a.	Niet - Weinig - Af en toe - **Meestal** - Altijd
3b.	Dokters worden meer uitgedaagd vanuit de complexe en interessante vraagstukken binnen hun vakgebied, waardoor dodelijke of ingrijpendere aandoeningen meer aandacht zullen krijgen dan langdurige, chronische aandoeningen, en waardoor men daar ook meer open staat voor nieuwe technologieën.
4.	Er wordt wel eens gezegd dat dit 16 jaar kan duren van fundamenteel onderzoek tot werkelijk in de markt gezet wordt. Dit ligt wel aan het soort technologie; medisch gerelateerde technologieën zullen vaak langer duren met alle regelgeving er om heen, maar social media, wat ook een vorm van technologie is, heeft een andere implementatietijd. De gemiddelde tijd waarin iets geaccepteerd wordt in de gezondheidzorg is, denk ik, wel langer dan in andere sectoren.
5a.	Niet - **Weinig** - Af en toe **- Meestal** - Altijd
5b.	Professionals/medici zijn gedreven vanuit de inhoud van hun vakbeoefening - bedrijfsvoering kant zijn ze minder geïnteresseerd. Het management om de zorg heen maakt wel veel meer gebruikt van externe adviseurs.
6a.	Niet - Weinig - Af en toe - Meestal - **Altijd**
6b.	Er is een hiërarchische manier van denken (mede gevoed vanuit het gilde-denken).
7a.	Niet - Een beetje - Gewoon - Best wel – **Heel erg**
7b.	Gezaghebbende dokters met goede reputatie zijn vooral binnen de eigen 'groep' wel bekend, maar naar buiten toe nog niet zo heel erg. Deze personen zouden als boegbeeld gebruikt kunnen worden Als toeleverancier moet je echt contact hebben met gezaghebbende professionals, wat kan zorgen voor extra 'marketing waarde' voor je product.
7c.	
8a.	Geen - Een beetje – Gewoon - Best wel - **Sterk**
8b.	De sector is nog steeds niet los van het 'gilde-denken'. Het persoonlijk leertraject tussen dokter en leerling geldt nog steeds. Bij bedrijven geldt dit ook. Zij hebben vaker te maken, zeker in de curatieve zorg, met artsen. Dit verandert wel steeds meer, omdat de verhouding tussen ziekenhuizen en artsen aan het veranderen is. Specialisten en andere artsen zijn steeds minder vaak 'vrij gevestigd' en de integrale bekostiging zorgt er voor dat prestaties worden gedefinieerd. Hierbinnen wordt het ziekenhuis steeds vaker de contractpartner van technologische bedrijven i.p.v. de individuele arts. Keuzes voor inkoop moeten ook steeds meer gerationaliseerd worden door de beperkte middelen. En de vrijheid voor dokters om zelf hun technologische snufjes uit te kiezen en aan te schaffen wordt steeds kleiner.
8c.	
9a.	Geen – Een beetje – Gewoon – Best wel – Sterk
9b.	-
10.	Medisch inhoudelijk: fundamenteel wetenschappelijk onderzoek is nodig.

	Het moet in het pakket zitten/vergoed worden (CVZ) Er moet een pionier/innovator zijn die dit als eerste wil doen (toonaangevende instellingen die er als eerste mee aan de slag gaan).
11a.	Niet - Weinig - Af en toe - **Meestal - Altijd**
11b.	Iets ontwikkelen gaat beter als je het in samenwerking doet met een eindgebruiker. Het lijkt tegenwoordig onmogelijk om iets te maken zonder dat het op deze manier geaccepteerd/getest wordt. Samenwerkingen tussen producenten en eindgebruikers komen ook steeds vaker voor.
11c.	-
12a.	Niet - Weinig - Af en toe - **Meestal - Altijd**
12b.	Niet - Een beetje - Af en toe - Best wel - **Heel erg**
13.	Leverancier-klant, kennisinstituut-producent, zorginstelling-producent, zorgverzekering-producent, etc.
14.	Patiënten (wel pluriforme doelgroep), zorgaanbieders (psychologen, fysio's, huisartsen, specialisten), instellingen/instituten (incl. bestuurders, OR's, personeelsgroepen), zorgverzekeraars, toeleveranciers, financiers, politiek (VWS, RIVM), bedrijfsleven (50% betalers van zorg), overheidsorganen (NZA, NMA, Raad volksgezondheid, CZV).
15.	Ze zitten allemaal in een keten die afhankelijk zijn van elkaar.
16.	Helemaal niet – **Niet echt** – Een beetje – Behoorlijk – Heel erg Iedere partij werkt heel erg vanuit het eigen perspectief en domein en probeert op die manier invloed uit te oefenen op de zorg. Samenwerking tussen medici en industrie zijn wel voorbeelden van, maar die zijn nog wel beperkt, wat in de toekomst waarschijnlijk meer zal gaan gebeuren, omdat het ook de acceptatie zal vergemakkelijken (zonder dat iemand een commercieel belang heeft).
17.	-
18a.	Nieuwe spelers hebben geen geloofsbrief/track-record, waardoor ze wel met een heel goed idee moeten komen wat de zorg spectaculair op het gebied van kwaliteit, toegankelijkheid of betaalbaarheid verbeterd. Een samenwerkingspartner is ook gerelateerd aan welke functie je moet focussen (zorgverzekeraar – betaalbaarheid, zorginstelling – kwaliteit).
18b.	
18c.	
19.	Niet - **Weinig** - Af en toe - Meestal - Altijd
20.	Niet - **Weinig** - Af en toe - Meestal – Altijd

	Er is heel veel informatie, maar er wordt erg weinig gebruik van gemaakt. Het EPD is hier een voorbeeld van; want het lukt maar niet om een fundament te bouwen om alle informatie te kunnen delen (mede door het hiërarchische karakter van de sector). Onderwerpen als privacy en gevoeligheden worden er heel vaak 'overdreven' bijgehaald, waardoor problemen op het gebied van kwaliteit en doelmatigheid blijven bestaan.
21.	Eens per jaar – eens per maand – eens per week – dagelijks – …
22.	Niet - Weinig - Af en toe - **Meestal** - Altijd
22.	Als een gerenommeerd instituut of arts zich aansluit, zal dit sneller succesvol zijn dan wanneer het niet gebeurd.
23.	Niet - Een beetje - Gewoon - Best wel – **Heel erg**
24.	Ja, soms zelfs te veel. Er is juist te weinig contact tussen de CEO en de dagelijkse gang van zaken. Dit mede door de omvang en complexiteit van bepaalde instellingen, waardoor ze veel te veel diensten leveren aan een veel te grote doelgroep. Als ze meer gevoel en zicht hebben op het primaire proces, kunnen ze hun eigen rol beter uitvoeren en meer focus en kwaliteit realiseren.
25.	Nooit - **Heel soms - Soms** - Vaak – Altijd Spectaculaire voorbeelden zijn er wanneer de inspectie fouten ontdekt en afdelingen sluit. Het gebeurt nog te weinig vooraf met het strenger reguleren/sturen van bijvoorbeeld het opzetten van specialistische centra. De zorgverzekeraars worden hierbij vaak te laat bij betrokken. Zij zijn nu wel bezig steeds actiever betrokken te raken bij het de opzet van een nieuwe technologie, zodat dit centraal in één instituut geregeld gaat worden. Dit is een vorm van 'dwangmaatregel' of invloed uitoefenen.
26.	Niet - **Weinig** - Af en toe - Meestal – Altijd Heel vaak beperkt de kennis zich alleen tot de direct betrokkenen. En dat de impact op de breedte van het zorgsysteem ook niet bekend is en dat mensen ook vaak niet weten hoe ze daar wel mee om moeten gaan. Verwachtingen zijn vaak scheef getrokken, waardoor geldstromen ook verkeerd kunnen gaan. Heel vaak is dit gebaseerd op beeldvorming/media, i.p.v. ratio.
27a.	Kabinet, 1e en 2e kamer (incl. Oud-top-politici die bij producten of andere

27b.	zorginstellingen gaan werken). Daarnaast zijn er ook de patiëntenorganisaties (door vele leden proberen zij vaak invloed uit te oefenen op de politiek), ouderenbonden, provincies (hebben geld en weinig taken/bestaansrecht), gemeentes (die steeds meer taken toegeschoven krijgen vanuit het rijk, die zullen dus politiek steeds actiever worden). Europese invloed: Tot nu toe was het zo dat ieder land z'n eigen sociale systeem mocht hebben, maar door ons privaatrechtelijk zorgsysteem hebben (allemaal private partijen) en door te toenemende toelating van verzakelijking en concurrentie, komt het ook steeds meer onder toezicht te staan van Brussel.
27c.	Binnen de kaders die Europa stelt, bepaald op dit moment het Rijk nog de wet- en regelgeving. Er wordt op Europees niveau voor technologie wel steeds meer gewerkt naar een FDA-achtig instituut. Versnippering van de instituten (EMA, CEE) geeft nu nog een concurrentie voordeel. Goedkeuring bij de FDA geeft comfort dat er goed en kritisch naar gekeken is, maar nog geen garantie dat het in Nederland ook goedgekeurd wordt.
28a.	
28b.	In principe zijn de 'controle organisaties' autonoom en onafhankelijk en eventueel de minister heeft daar een vorm van verantwoordelijkheid over, wel wordt de kennis uit meerdere instituten gehaald. Misschien dat ze wel rekening houden met de kostenopvoering van de zorg.
29.	Niet – **Niet echt** – Redelijk – Best wel - Heel erg Het is op dit moment in transitie. Er zal waarschijnlijk meer vermengen met andere onderdelen van de sociale activiteiten (wonen en pensioenen) van de overheid.
30.	Niet – Niet echt – Redelijk – Best wel **– Heel erg** Politiek is erg gevoelig voor incidenten, en zeker de gevallen over leven en dood. Dit wordt ook makkelijk opgepikt door de media, waardoor de politiek ook weer onder druk komt te staan. (Hierdoor zouden aandoeningen met een minder spectaculair verloop misschien wel minder aandacht krijgen dan nodig is).
31.	Heel lang – lang – **normaal** – kort – heel kort Dit is afhankelijk van de context (door crisis zijn maatregelen mogelijk die een paar jaar terug niet mogelijk leken te zijn).

32a.	Niet – Niet echt – Redelijk – **Best wel – Heel erg**
32b.	Het zijn vrij starre systemen. In onzekere tijden lijken mensen vast te houden aan 'dat wat er was' en zijn nodige veranderingen moeilijk om door te voeren. (Basaal menselijk gedrag).
33a.	Nee
33b.	-
34a.	Ja
34b.	Nu vooral op het gebied van fundamenteel onderzoek en te weinig voor 'vermarktbare' producten (de implementatie van een technologie in de markt). De beperking in subsidie heeft wel het positieve gevolg dat innovaties die voorheen 'omvielen' als de subsidiekraan dichtging, niet meer opgezet worden.
34c.	Niet genoeg om de knelpunten van technologische innovatie te verhelpen, maar subsidie helpt wel degelijk. Op dit moment denkt fundamenteel onderzoek te weinig naar 'de vraag' op de markt en houdt te veel vast aan de academische vrijheid. Cross-sectorale samenwerking zou op een andere manier innovaties teweeg moeten brengen.
34d.	-
35a.	Nooit - Heel soms - Soms - **Vaak – Heel vaak** (in het geval van medische technologie wel, maar voornamelijk technologie push).
35b.	Variërend
36a.	Bronnen van financiering voor innovatie: instellingen (R&D), overheidssubsidies (fundamenteel, NWO), zorgverzekeraars, MKB-regelingen (garantieregelingen), private equity, private personen (deze staan op dit moment wel allemaal onder druk als gevolg van de economische problemen).
36b.	Laag – **Iets minder – Gelijk** – Iets hoger – Hoog Het totaal viel tegen.
37a.	Nooit - **Heel soms -** Soms - Vaak – Heel vaak Niet genoeg > rondom ICT zijn er bijvoorbeeld geen standaarden en een slechte uitwisselbaarheid. De Nederlandse markt is eigenlijk te klein om bijvoorbeeld software systemen van grote bedrijven up-to-date te kunnen houden. Het kost te

	veel geld. Internationale systemen zouden daarin een betere oplossing zijn.
37b.	Nooit – **Heel soms – Soms** – Vaak – Heel vaak Niet vaak genoeg.
37c.	Ja
37d.	Software systemen internationaal
37e.	-
38.	Nooit - Heel soms - Soms - Vaak – Heel vaak
39a.	Nooit - Heel soms - **Soms** - Vaak – Heel vaak Best practices worden nog te weinig over genomen (not-invented-here systeem). Succesvolle systemen vinden hun weg uiteindelijk wel.
39b.	Ja, meestal als ze hun weg vinden, komt dat omdat ze toch wel heel succesvol zijn.
40a.	Geen – bijna geen – een paar – **best wel wat – heel veel**
40b.	Hiërarchisch systeem
41a.	Geen – bijna geen – een paar – **best wel wat – heel veel**
41b.	
42a.	Nooit - Heel soms - **Soms** - Vaak – Heel vaak
42b.	
43a.	Nooit - Heel soms - **Soms** - Vaak – Heel vaak
43b.	
44a.	Laag – vrij laag – gemiddeld – vrij hoog – Hoog
44b.	
45a.	Niet – Niet echt – Redelijk – Best wel - Heel erg
45b.	
46a.	Niet – Niet echt – **Redelijk** – Best wel - Heel erg
46b.	Sommige technologie wel, andere niet
47a.	Laag – middel – Hoog – universitair – universitair +
47b.	
48.	Ja, ik ken het boek van Christensen
49.	Buurtzorg Nederland, ZBC's/focusklinieken (Bergman klinieken), Zorgdomein,
50.	Mammaprint, TV-foon MeaVita, Mobiele Diabetes Checkpoint

Interview Kim Egger on Medical Technology Sector 08-05-2013	
Nr.	**Answer**
1a.	Niet - Weinig - **Af en toe -** Meestal - Altijd
1b.	Het is een gevarieerde groep gebruikers. Er zijn medici/artsen die altijd voorop willen lopen en nieuwe ontwikkelingen graag tegemoet komen. Binnen deze groep gebruikers die bestaande routines moeten aanpassen, wat 'normale' weerstand oproept. Dit geldt met name voor verplegend personeel. Patiënten zullen ook voor weerstand zorgen, maar makkelijker te overtuigen als bewezen kan worden dat de kwaliteit enorm toeneemt. Dit is niet anders dan in andere sectoren.
2a.	Niet - Weinig - Af en toe - **Meestal** - Altijd
2b.	De impact van een nieuw product potentieel groter is, dan is dat waarschijnlijk van invloed op de acceptatie.
3a.	Niet - Weinig - Af en toe - **Meestal** - Altijd
3b.	De impact van een nieuw product potentieel groter is, dan is dat waarschijnlijk van invloed op de acceptatie. Als mensen overtuigd zijn van een verbeterde werking of verhoogde impact zal dit zeker de acceptatietijd versnellen.
4.	Minimaal 2 of 3 jaar (grove schatting). Er is wel verschil tussen incrementele aanpassingen of nieuwe aanpak. Dit geldt vooral voor de tweede.
5a.	Niet - Weinig - Af en toe - **Meestal** - Altijd
5b.	De meeste mensen zijn heel erg innovatiegericht in deze sector. Ze zijn heel erg gefocust op nieuwe technologieën en het op de markt brengen daarvan. Op de grote beurzen komt dit ook naar voren als mensen daar het nieuwste van het nieuwste laten zien. Alles wat helpt om een innovatie op de markt te brengen en succesvol te maken staan ze voor open.
6a.	Niet - Weinig - **Af en toe** - Behoorlijk – Heel erg
6b.	Het gaat vaker primair om het product zelf, maar grote partijen zullen daar voordeel van hebben. Voor kleine bedrijven om onder de aandacht te komen is het wel behulpzaam om iemand met status erbij te hebben.
7a.	Niet - Een beetje - Gewoon - **Best wel** – Heel erg
7b.	Om een product op de markt te brengen zal een Siemens of Philips dat

	makkelijker voor elkaar krijgen. De kleine bedrijven die met echte innovaties komen
7c.	Voor kleine bedrijven zal status en prestige dus helpen om eerder onder de aandacht van de grote partijen te komen, die hun producten kunnen helpen om op de markt te zetten.
8a.	Geen - Een beetje – Gewoon - **Best wel** - Sterk
8b.	Door het nationale karakter van de gezondheidszorg per land, is dit heel erg verschillend van land tot land. Dit is afhankelijk van en beïnvloed door de cultuur van een land, maar ook door de in die sector ingesleten gewoontes vormen tradities. De medische technologiemarkt is daarentegen heel mondiaal, waar dus minder culturele tradities zullen zijn, behalve dan rekening houdend met de tradities in de nationale gezondheidszorgsystemen.
8c.	Alle spelers/producenten van medische apparatuur zijn internationaal georiënteerd. Wel is het zo dat bijvoorbeeld Philips een sterkere positie heeft in Nederland dan bijvoorbeeld in Japan, waar de plaatselijke bedrijven een veel groter marktaandeel hebben.
9a.	**Geen** – Een beetje – Gewoon – Best wel – Sterk
9b.	Er zijn veel verschillende spelers van over de hele wereld. Er is juist heel veel diversiteit.
10.	Door vroegtijdige samenwerking met ziekenhuizen of universiteiten, waar clinical evidence wordt vergaard. Verbetering van behandelresultaten moeten worden aangeleverd. Dit geldt voor alle apparaten, omdat ieder apparaat veilig bewezen moet zijn. CEE in Europa (FDA in de USA), en die richtlijnen moeten sowieso aan voldoen worden. Succes in de markt moet vooral bewezen worden door toegevoegde waarde. Wetenschappelijke artikelen worden hier vaak mee gecombineerd.
11a.	Niet - Weinig - Af en toe - Meestal - **Altijd**
11b.	Dit wordt gebruikt om de veiligheid te kunnen testen en de werkzaamheid. Een prototype is altijd een standaardonderdeel in het ontwikkelproces. Deze zullen gebruikt worden om testen uit te voeren, maar ook om de veiligheid aan te kunnen tonen.
11c.	-
12a.	Niet – Weinig – Af en toe – **Meestal – Altijd**
12b.	In het geval van samenwerkingen met producenten en bijvoorbeeld ziekenhuizen.
12c.	Niet - Een beetje - Af en toe - Best wel - **Heel erg**
13.	Leverancier-klant, kennisinstituut-producent, zorginstelling-producent, zorgverzekering-producent, etc.
14.	Grootste spelers zijn Philips, Siemens, GE, (Toshiba); dit is allemaal imaging, maar deze bedrijven zijn wel bezig om in de toekomst op een andere manier te specificeren (Philips heeft voor personal health/domotics gekozen). CEE, overheid, ziekenhuizen, zorginstellingen, universiteiten (UMC's), financieringspartijen, (zorgverzekeraars).
15.	Vooralsnog zijn het een hoop samenwerkingen, vooral tussen producenten en ziekenhuizen. Ook met prestigieuze ziekenhuizen over de hele wereld proberen producenten samenwerkingsverbanden aan te gaan om nieuwe producten te realiseren. Verzekeraars en 'controleurs' hebben een wat meer 'remmende' of beperkende rol. Zij zitten ook vaak meer aan het vervolgtraject en niet in de opbouwfase.
16.	Helemaal niet – Niet echt – Een beetje – **Behoorlijk – Heel erg** > dit zijn over het algemeen heel intensieve samenwerkingen, meer een vorm van co-makership.
17.	-
18a.	Het is vrij lastig voor een nieuwe partij, omdat klanten niet zo happig zijn op het kopen van apparaten van nieuwe spelers. Continuïteit, kwaliteit en service zijn hierbinnen heel belangrijk. Dat maakt het voor kleine, nieuwe partijen lastig om een aandeel in de markt te krijgen.
18b.	Vaker heeft een kleine partij bewijs nodig van het product en zal dan in samenwerking met of opgekocht worden door een grote partij om alsnog de producten op de markt te kunnen brengen.
18c.	Continuïteit, kwaliteit en service zijn moeilijker te garanderen.
19.	Niet - **Weinig - Af en toe** - Meestal - Altijd
	Men probeert zoveel mogelijk af te schermen om de concurrent en markt te kunnen verrassen, maar in samenwerking met een universiteit is dit een stuk lastiger en is er per definitie meer bekend over de technologie. Open innovatie is ook nog niet echt doorgedrongen tot deze sector. Samenwerkingen tussen de grote producenten vindt niet plaats.
20.	Niet - Weinig - Af en toe - **Meestal** - Altijd

	Contact tussen de zorgsector en de industrie zijn veel contacten. Technologiebedrijven hebben ook vaak medici of met medische achtergrond in dienst om de communicatie makkelijker te maken.
21.	Eens per jaar – eens per maand – eens per week – dagelijks – …
22.	Niet - Weinig - Af en toe - **Meestal** - Altijd
22.	Hoge autoriteit helpt bij de lancering van een product?
23.	Niet - Een beetje - Gewoon - Best wel – **Heel erg**
24.	Niet meer dan in andere sectoren.
25.	Nooit - **Heel soms** - Soms - Vaak - Altijd
	Vanuit veiligheid of geld overwegingen. Een voorbeeld hierbinnen is bijvoorbeeld protontherapie die erg prijzig is, maar op kleine schaal werkzaam.
26.	Niet - Weinig - Af en toe - Meestal - Altijd
27a.	Overheid, CEE, verzekeraars, (uitzoeken of VWA ook hier iets over te zeggen heeft!)
27b.	
27c.	CEE bepaald op Europees niveau de regels en richtlijnen, en daar houdt de Nederlandse overheid zich in aan. > Dit nog wel verder uizoeken
28a.	CEE + NL overheid > uitzoeken (Kemakeur), er zijn nationale keurbedrijven die nog het één en ander bepalen op nationaal niveau, maar dit wordt steeds meer centraal Europees geregeld.
28b.	Medici/zorgverleners en de medische instellingen, patiëntenorganisaties, producenten/bedrijven zullen zeker ook lobbyen en gebeurt vrij veel.
29.	Niet – Niet echt – Redelijk – Best wel - **Heel erg** > het is een sector die al vrij lang stabiel is en evolueert.
30.	Niet – Niet echt – Redelijk – **Best wel** – Heel erg > beleid rondom kanker Steeds meer ouderen, zij zijn ook de zieken, maar ook degenen die stemmen, dus beleid kan daardoor wel beïnvloed worden.
31.	Heel lang – lang – **normaal** – kort – heel kort
	> bij grote veranderingen kan het heel lang duren, maar bij kleine veranderingen gaat dit veel sneller. Disruptive innovations die de uitvoerder of gebruiker doen veranderen weet ik niet hoe en op welk niveau beleidsveranderingen moeten worden doorgevoerd.
32a.	Niet – Niet echt – Redelijk – **Best wel** – Heel erg
32b.	
33a.	Nee, er gelden gewoon de normale concurrentieregels.
33b.	
34a.	Ja
34b.	Overheden zullen sneller subsidiëren in de vorm van onderzoek, maar niet in de aanschaf van een nieuwe technologie. Er zullen ook wel subsidiestromen zijn die voor kleine technologiebedrijfjes zullen ondersteunen. Grote partijen als Philips zullen daar niet zo snel subsidie voor krijgen. Vanuit Brussel zijn er wel geldstromen, waaronder een recent e-Healthproject waarover Philips de leiding heeft samen met het UMCG en andere, internationale partijen.
34c.	Jazeker, ondanks dat niet al het geld de juiste weg vindt, zal over het algemeen het de innovatieprestatie verbeteren.
34d.	
35a.	Nooit - Heel soms - Soms - Vaak – **Heel vaak** Er is een hoge R&D intensiteit
35b.	Variërend; van heel eenvoudig tot heel complex.
36a.	Geen idee
36b.	Laag – Iets minder – Gelijk – Iets hoger – **Hoog** 30% van al het wetenschappelijk onderzoek is gericht op gezondheidszorg.
37a.	Nooit - Heel soms - Soms - **Vaak** – Heel vaak
	Op het gebied van medische technologie zal er wel vaak voor dezelfde apparaten gekozen worden. Dit is bijvoorbeeld van belang bij het opleiden van personeel, wat heel ineffectief zou zijn als ze meerdere apparaten van verschillende aanbieders en met andere functies moeten leren bedienen.
37b.	Nooit – Heel soms – Soms – Vaak – Heel vaak
37c.	Ja/nee
37d.	
37e.	
38.	Nooit - Heel soms - Soms - Vaak – Heel vaak
39a.	Nooit - Heel soms - Soms - **Vaak – Heel vaak**
39b.	Ja, zoals Mindray, een Chinees bedrijf dat als serieuze partij meedoet met beeldvorming, hoog-technologische markt als wereldwijd grote partij. Op kleine schaal en bij simpelere producten zal dit vaker

	voorkomen.
40a.	Geen – bijna geen – een paar – **best wel wat – heel veel**
40b.	De hele gezondheidszorg ligt in rigide protocollen vast. Voor producenten van medische technologie zal het niet anders dan in andere sectoren zijn.
41a.	Geen – bijna geen – **een paar** – best wel wat – heel veel
41b.	Traditioneel zit iedereen op zijn eigen terrein. Hier is tegenwoordig wel meer verandering in te zien.
42a.	Nooit - Heel soms - **Soms - Vaak** – Heel vaak
42b.	Ja, tegenwoordig kunnen mensen makkelijker meteen naar een specialist, in plaats van eerst naar een huisarts te gaan.
43a.	Nooit - Heel soms - Soms - **Vaak – Heel vaak**
43b.	Er is steeds meer verandering gaande.
44a.	Laag – vrij laag – gemiddeld – **vrij hoog** – Hoog
44b.	Ik weet niet of dit echt een belemmering is. Natuurlijk zijn er partijen die veel geld hebben geïnvesteerd in één bepaalde technologie en de keuze om ergens uit te stappen (verdienmodel van de farmaceuten of voorbeeld van JSF). Dit kan hun ook belemmeren om in nieuwe technologieën te investeren.
45a.	Niet – Niet echt – **Redelijk – Best wel** - Heel erg
45b.	Er is veel informatie beschikbaar en over een hoop wordt gepubliceerd. Op het moment dat iets concurrentiegevoelig is, wordt dit wel een stuk lastiger. In samenwerking met universiteiten is het veel lastiger om kennis niet te verspreiden.
46a.	Niet – Niet echt – **Redelijk – Best wel** - Heel erg
46b.	
47a.	Laag – middel – **Hoog** – universitair – universitair +
47b.	
48.	Ja
49.	
50.	Brachy technique (Nucletron, overgenomen door Electra) HiFu > Zet niet door?

Interview Marc Koolen on Pharmaceutical Sector – 14-05-2013	
Nr.	**Answer**
1a.	Niet - **Weinig - Af en toe** - Meestal - Altijd
1b.	De industrie staat steeds meer open voor het uitwisselen van kennis en informatie rondom farmaceutische kennis (12.000 opengestelde patenten in Spanje voor anderen om mee te werken). De sector zit wel vast in z'n eigen niche, waarin weinig kennisuitwisseling plaatsvindt tussen andere sectoren zoals te ICT. Daar zou veel winst te behalen kunnen zijn als daar op een strategische manier mee wordt omgegaan.
2a.	Niet - Weinig - Af en toe - **Meestal - Altijd**
2b.	Hoe meer patiënten hoe groter de vraag.
3a.	Niet - Weinig - Af en toe - **Meestal - Altijd**
3b.	De politieke lobby vanuit patiëntenverenigingen, met name voor ernstige ziekten, heeft duidelijke een grote invloed op de acceptatie en doorstroom van medicatietechnologie.
4.	Maximaal 20 jaar (tijd van een patentverloop). Gemiddelde 8 jaar tot registratiemoment (fundamenteel onderzoek + klinische trials) en dan zo snel mogelijk op de markt brengen. Break through innovation, aantal patiënten, standard of care, vergoeding, adoptie door beroepsgroep, etc. beïnvloeden de snelheid van marktentree.
5a.	Niet - Weinig - **Af en toe - Meestal** - Altijd
5b.	Het openstellen van patenten voor andere bedrijven om mee te werken is hier van een voorbeeld. De farmaceutische sector wordt steeds meer gedwongen zich transparant op te stellen. GSK stelt bijvoorbeeld al z'n onderzoeksresultaten open op internet. Ook betalingen zijn transparant gemaakt (eigenlijk op vraag vanuit de maatschappij). Bestuurders en management zullen sneller geneigd zijn om advies van buitenaf aan te nemen of te gebruiken voor de verbetering van de interne processen; onderzoekers zullen minder snel geneigd zijn dit te doen.
6a.	Niet - Weinig - Af en toe - **Meestal - Altijd**
6b.	Een opgebouwde reputatie (prestige en status) heeft zeker zijn voordelen. Dit is gebaseerd op het bewijs in hoeverre je succesvol bent

	geweest om geneesmiddelen goed in de markt te zetten. De allerbeste onderzoekers zijn onlosmakelijk verbonden aan de farmaceutische industrie; want er moet onderzoek gedaan worden om medicatie op de markt te krijgen en de onderzoekers hebben geld nodig om onderzoek te kunnen doen.
7a.	Niet - Een beetje - Gewoon - **Best wel – Heel erg**
7b.	-
7c.	Dat men in staat is om onderzoek te kunnen laten uitvoeren door de beste onderzoekers, of dat de onderzoekers daar investering voor kunnen vinden.
8a.	Geen - Een beetje – Gewoon - **Best wel - Sterk**
8b.	Traditioneel is het een interngerichte sector. Andere sectoren worden sneller gedwongen door concurrentie om zich open te stellen. Door de aard van de innovaties hebben partijen vrij lang een 'monopolistische' positie. Wereldwijd is er daarentegen geen partij met een marktaandeel hoger dan 5%. Met deze situatie zijn bedrijven niet erg geneigd om naar buiten te kijken. Alleen concurrentie of veranderende regelgeving zou dit kunnen veranderen. De manier van innoveren gebeurt vaak door kleine of middelgrote bedrijven (50-100 man) die innovatief onderzoek doen te ondersteunen of op te kopen.
8c.	
9a.	Geen – Een beetje – **Gewoon** – Best wel – Sterk
9b.	-
10.	Traditioneel: Effectiviteit, werkzaamheid/kwaliteit en veiligheid. Vanuit de betaler meer: kosteneffectiviteit. Dit is wel gereguleerd.
11a.	Niet - Weinig - Af en toe - Meestal - **Altijd**
11b.	Voor medicatie zou dit dan meer op dierproefniveau te zitten. Op mensen wordt alleen getest met het 'echte' medicijn. Apparaten moeten bewezen veilig en effectief zijn en daar zijn ook prototypes voor nodig.
11c.	
12a.	Niet - Weinig - Af en toe - Meestal - **Altijd**
12b.	Niet - Een beetje - Af en toe - Best wel - **Heel erg** Zonder kunnen producten niet op de markt komen of worden vergoed.
13.	Leverancier-klant, kennisinstituut-producent, zorginstelling-producent, zorgverzekering-producent, etc.
14.	CBG, EMA, FDA (regulatory), onderzoekers, universiteiten, Chemia/onderzoeksbedrijven, patiënten, vrijwilligers (developers), vergoedingsauthoriteit (CVZ),
15.	In toenemende mate werken deze partijen samen. Regulatory boards zijn juist onafhankelijk van elkaar, maar overleg vindt steeds vaker plaats. Een snelle toelatings- en registratieprocedure kan ten goede zijn voor de bedrijven en patiënten, maar kan veiligheid in het geding brengen. Samenwerkingen tussen onderzoeksinstellingen en instituten met het bedrijfsleven vindt heel veel plaats. Ook bij ziekenhuizen waar de trials uitgevoerd worden vindt veel samenwerking plaats.
16.	Helemaal niet – Niet echt – **Een beetje** – Behoorlijk – Heel erg
17.	-
18a.	Basisvaardigheden moeten uitgevoerd kunnen worden. Molecuul kunnen maken, opschalen, testen, (geld, kennis en kunde). Continuïteit, service en kwaliteit als basis voor bedrijven.
18b.	
18c.	
19.	Niet - Weinig - Af en toe - **Meestal – Altijd** Dit is afhankelijk van de informatie. In principe geldt er voor dat de patenten en onderzoeksresultaten vrijgegeven worden. Afspraken over prijs e.d. worden onder concurrentiebelang niet vrijgegeven. Op geen enkele manier.
20.	Niet - Weinig - Af en toe - **Meestal – Altijd** Daar zijn 'strikte' regels en richtlijnen voor. Ethische normen en waarden bepalen hier in wat gecommuniceerd wordt en wat niet. Transparantie wordt steeds meer nagestreefd.
21.	Eens per jaar – eens per maand – eens per week – dagelijks – …
22.	Niet - Weinig - Af en toe - Meestal - Altijd
22.	
23.	Niet - **Een beetje - Gewoon** - Best wel – Heel erg Er zijn een paar bedrijven met 'wat' marketshare, en zolang een patent loopt ben je 'monopolist' of 'oligopolist'. Er zijn ongeveer 100 bedrijven in de hele wereld.
24.	Er is contact. Er is overleg over dingen die de concurrentie niet in het geding brengen, waar strikte afspraken zijn over wat wel en niet besproken mag worden of wat wel en niet overgedragen (cadeau's e.d.)

	mag worden. Voorbeelden hierbinnen kunnen zijn waar samenwerkingen op het gebied van weesgeneesmiddelen kunnen worden vormgegeven.
25.	Nooit - **Heel soms - Soms** - Vaak - Altijd
26.	Niet - Weinig - **Af en toe - Meestal** – Altijd Op zekere hoogte wel. De echte 'keukengeheimen' natuurlijk niet, maar iemand met veel juiste contacten in de markt zal goed op de hoogte zijn van wat er speelt bij de verschillende partijen. Reuters met 'The Ones to Watch' geeft overzichten van welke partijen komende paar jaar op de markt komen met welke producten en waar iedereen mee bezig is. Op die manier is de transparantie, en dus kennis over de innovaties, vrij hoog; als men het bijhoudt.
27a.	Number
27b.	CBG, EMA, CVZ, VGZ (vaccins), Ministerie VWS, GR, RIVM,
27c.	Zie boekje GSK
28a.	Zie boekje GSK
28b.	Een formele rol is weggelegd voor de beroepsgroep (bijv. Nvalt (longartsen), voorschrijvers en onderzoekers bepalen de richtlijnen). Bedrijven kunnen wel op verzoek van instanties of op congressen en symposia kennis uitwisselen over geneesmiddelen, medicatie en andere producten (dit is beperkt tot het uitwisselen en niet om marktaandeel te vergroten). Stemrecht in bijvoorbeeld de GR is alleen weggelegd voor onderzoekers en experts zonder banden met de industrie.
29.	Niet – Niet echt – Redelijk – **Best wel - Heel erg** De systematiek zal wel in stand blijven. De economische situatie is niet goed, waardoor veranderingen op basis van bezuinigingen wel zullen gaan gebeuren. De farma sector is al jarenlang heel stabiel. De gezondheidszorg is, mede door deze bezuinigingen, wel aan verandering onderhevig. De marges voor de geneesmiddelen zullen over 10-15 jaar ook niet meer hetzelfde zijn als wat ze tot nu toe zijn geweest. Ook kan een farmaceut niet meer alleen bezig zijn met het op de markt brengen van een geneesmiddel. De begeleiding, informatie en service rondom een geneesmiddel wordt dan steeds belangrijker.
30.	Niet – Niet echt – Redelijk – **Best wel** – Heel erg Door de druk van de patiëntenvereniging kan voor medicatie die zeldzame, ernstige ziekten echt genezen wel beïnvloeden.
31.	Heel lang – lang – normaal – kort – heel kort 2-5 jaar
32a.	Niet – Niet echt – Redelijk – **Best wel – Heel erg**
32b.	Door een de strenge regulering rondom geneesmiddelen speelt bureaucratie een grote rol. Registratie gebeurt op verschillende niveaus (Europees en nationaal) en voor ieder land weer apart voor registratie en vergoedingsproces en dit kost een hoop tijd.
33a.	Ja
33b.	Door middel van patenten.
34a.	Ja
34b.	ZonMW GGG (goed gebruik geneesmiddelen): voor weesgeneesmiddelen. Dit is met name voor de wat kleinere bedrijven. Er zijn ook wel andere stimulerende fondsen.
34c.	Vast wel.
34d.	
35a.	Nooit - Heel soms - **Soms** - Vaak – Heel vaak Afgelopen jaar 27 introducties bij de FDA.
35b.	
36a.	1,2 miljard (800 miljoen-1,5 miljard) per nieuw op de markt geïntroduceerd medicijn over een periode van 8 jaar. GSK heeft een omzet van ong. 30 miljard en geeft daarvan 4,5 miljard uit aan R&D (=17%). Snel en grof uitgerekend: GSK heeft een marktaandeel wereldwijd van 3 tot 4%, 5 miljard x 20 = 100 miljard wordt jaarlijks geïnvesteerd in R&D in de farmaceutische industrie wereldwijd.
36b.	Laag – Iets minder – Gelijk – Iets hoger – **Hoog**
37a.	Nooit - Heel soms - **Soms** - Vaak – Heel vaak Standaarden zijn er op het gebied van bereidingswijze, klinisch onderzoek, welke waarden onderzocht worden, etc. Vormgeving e.d. wordt wel allemaal vrij ingevuld, wat ook weer kan leiden tot frustratie van de gebruikers.
37b.	Nooit – Heel soms – Soms – Vaak – Heel vaak
37c.	Ja/nee
37d.	
37e.	

38.	Nooit - Heel soms - Soms - Vaak – Heel vaak
39a.	Nooit - Heel soms - Soms - Vaak – **Heel vaak** Er zijn natuurlijk wel verschillen tussen de 'innovatieve farma bedrijven' en de 'me2/generieke bedrijven' die juist na patentverloop aan de slag gaan met imitaties. Iedereen in de markt heeft dus te maken met imitaties
39b.	Ja, (Teva is een grote farmaceut die alleen generieke medicatie produceert).
40a.	Geen – bijna geen – een paar – best wel wat – **heel veel**
40b.	Alleen maar, alles is gereguleerd. Ook onderzoek, reclame, relaties en hoe daar mee om te gaan staat vaak vastgesteld in gedragscodes.
41a.	Geen – **bijna geen** – een paar – best wel wat – heel veel
41b.	Dit kan niet, vrijheid en concurrentie worden streng gereguleerd door de NMA.
42a.	Nooit - Heel soms - **Soms** - Vaak – Heel vaak
42b.	Voorschrijven van bijvoorbeeld COPD medicatie bij Astmapatiënten 'mag' niet, maar gebeurt soms wel als een arts daar een goede rede voor heeft. Dit wordt eigenlijk nooit gecontroleerd en dus zal er soms wel diffusie plaatsvinden.
43a.	Nooit - Heel soms - Soms - Vaak – Heel vaak
43b.	
44a.	Laag – vrij laag – gemiddeld – vrij hoog – **Hoog**
44b.	Dit geeft het bestaansrecht voor farmaceuten. Zij investeren in geneesmiddelen van de toekomst. Investeringen geven de maat van het aantal geneesmiddelen dat in de pijpleiding zit. Investeerders zullen hier naar kijken.
45a.	Niet – Niet echt – Redelijk – Best wel - Heel erg
45b.	
46a.	Niet – Niet echt – Redelijk – Best wel - Heel erg
46b.	
47a.	Laag – middel – **Hoog – universitair – universitair +**
47b.	De corebusiness van de farmaceuten is kennisgebruik en kennisontwikkeling, waardoor het gemiddelde opleidingsniveau ook erg hoog is.
48.	Ja
49.	Insuline (synthetische productie) Cell novo Ventolyn > basis corticosteroiden Woudens pathofysiologie
50.	

Interview Hans Hofstraat on Medical Technology Sector – 17-05-2013	
Nr.	**Answer**
1a.	Niet - Weinig - Af en toe - **Meestal** - Altijd
1b.	De professionals staan open voor een nieuwe applicatie als er een vergoeding wordt gegeven. Bij acute, specialistische zorg is het altijd wat makkelijker. Op het niveau van de patiënt komt het gemiddeld wat minder vaak voor dat ze zelf op zoek gaan naar nieuwe technologie. (Ze gaan meestal gewoon naar de dokter die hen verteld wat ze moeten gebruiken). Ook zijn de Nederlandse patiënten niet bereid om zelf te investeren in hun eigen zorg (in vergelijking met India waar 81% wordt betaald door de mensen zelf). Op deze manier zijn de 'klanten' van medische technologieleveranciers eigenlijk altijd de medische professionals.
2a.	Niet - Weinig - **Af en toe** - Meestal - Altijd
2b.	Dit is afhankelijk van de ROI voor de medische technologie. De professional die deze aanschaft zal als ondernemer naar de meerwaarde hiervoor kijken. Voor de vergoeding kijkt een CVZ (of zorgverzekeraar) naar de veiligheid, klinische meerwaarde, kostenefficiëntie en de draagkracht onder de beroepsgroep.
3a.	Niet - Weinig - **Af en toe** - Meestal - Altijd
3b.	Bij aandoeningen waar nog geen behandeling voor bestaat, kan het regulatore proces zelfs versneld worden. Maar de meeste ontwikkelingen zijn additioneel, dus daar zal dit proces niet versneld zijn.
4.	Dit is afhankelijk van het soort innovatie. Kleine, incrementele verbeteringen, zoals bijvoorbeeld software technisch, gaan bijvoorbeeld veel sneller dan compleet nieuwe producten die het hele bureaucratische proces weer door moeten (dit kan een jaar of langer

	duren). Radicale innovaties die zullen helemaal opnieuw gekeurd moeten worden. De tijd die nodig is PMA (pre-market approval) approval bij de FDA en EMA te krijgen kan van eerste uitvinding tot implementatie wel tot 10 jaar duren.
	De gebruikers zijn niet alleen meer de specialisten, maar ook ziekenhuizen, zorgverzekeraars, en in mindere mate patiënten. Al zal in de toekomst
5a.	Niet - Weinig - Af en toe - Meestal - Altijd
5b.	-
6a.	Niet - Weinig - Af en toe - **Meestal - Altijd**
6b.	De grote bedrijven komen binnen bij de gebruikers en zijn in staat om de bewijzen af te leggen die nodig zijn om geaccepteerd te worden.
7a.	Niet - Een beetje - Gewoon - **Best wel – Heel erg**
7b.	Als producent moet je in staat zijn om kwaliteit, continuïteit en service te kunnen leveren. Dit kan je in een verleden al hebben bewezen. Ook als zorginstelling met een bepaalde specialiteit en prestige kan deze een product laten vallen of steunen. Het is daarom belangrijk voor producten om bij de juiste partijen binnen te zitten.
7c.	Het resultaat is dat er weinig verschillende soorten partijen zijn op bepaalde vlakken, omdat alleen zij die zich al een bepaalde status verworven hebben de kans krijgen om te innoveren. Zonder zo'n grote partij kan je niet op grote schaal afzetten.
8a.	Geen - Een beetje – Gewoon - **Best wel** - Sterk
8b.	De professionals in de gezondheidszorg zijn een redelijk conservatieve beroepsgroep. Daarbij komt dat het veelal geen 'wizkids' zijn die gemakkelijk en met veel plezier nieuwe (uitdagende) technologieën willen uitproberen. Er is dan ook weinig dynamica in de markt van klinische medische technologie. Een paar grote spelers die er al heel lang zitten en niet heel veel kleine spelers. Op het gebied van kleinere 'huis' technologie heb je wel veel meer kleine spelers die belemmerd worden door het gebrek aan schaalvergrotingsmogelijkheden.
8c.	
9a.	Geen – Een beetje – Gewoon – **Best wel** – Sterk
9b.	-
10.	Veiligheid (CE keurmerk), bewijs voor klinische meerwaarde/utility (vaak in samenwerking met key opinion leaders inclusief publicatie), healthcare economics component (bijv. in samenwerking met belangrijke ziekenhuizen gespecialiseerd in het specifieke ziektebeeld), CVZ, richtlijnen (wordt gedaan door de gebruikers met hulp van een producent)
11a.	Niet - Weinig - Af en toe - **Meestal - Altijd**
11b.	Anders kan er niet getest worden.
11c.	Hier kan ik geen exact getal aan hangen. Bij software patches test men gewoon op de eigen apparatuur en krijgt eventueel na het vrijgeven van de updates nog feedback van de gebruikers. Bij complete apparaten begint een prototype al bij een 'houtje-touwtje' opstelling waar nog niets wezenlijks op getest wordt. Met latere versies zal met vlees/proefdieren e.d. wel getest worden. En deze ontwikkelen zich steeds verder tot er op een gegeven moment klinische testen gedaan kunnen worden. Al vrij snel kan dit op menselijk weefsel (zoals met e-pathologie), maar met operatietechnieken (minimaal invasieve hartchirurgie) probeert het eerst uit op een varken, of op een kunsthart in een 'neplichaam'. Op het moment dat het varken 'genezen' kan worden, kan met over stappen naar mensen.
12a.	Niet - Weinig - Af en toe - **Meestal - Altijd**
12b.	Niet - Een beetje - Af en toe - **Best wel - Heel erg**
13.	Leverancier-klant, kennisinstituut-producent, zorginstelling-producent, zorgverzekering-producent, etc.
14.	Producenten, gebruikers (specialisten en patiënten), patiëntenvereniging, CEE (CE keurmerk, elektrische en stralingsveiligheid), EMA (Medical device directive), CVZ, IG (inspectie gezondheidszorg), Overheid (VWS), gemeenten, RIVM (risicoinventarisatie), distributeurs/groothandelaren, GR, > Hier zijn exact dezelfde stakeholders als in de farmaceutische industrie. Alleen inhoudelijk zijn er verschillen in wat men moet aanleveren
15.	Deze partijen zouden moeten samenwerken, maar hebben wel allemaal hun eigen interesses en randvoorwaarden. Ze werken vanuit een andere opdracht. Er zijn wel intensieve contacten met de partijen op

	verschillende niveaus.
16.	Helemaal niet – **Niet echt – Een beetje** – Behoorlijk – Heel erg
17.	-
18a.	Als producent moet je in staat zijn om kwaliteit, continuïteit en service te kunnen leveren. Dit kan je versterken door medisch specialisten en gerenommeerde ziekenhuizen aan te haken. Het hangt dus sterk samen met status en track-record.
18b.	
18c.	Een hoop hangt samen om de veiligheid van de patiënt te waarborgen.
19.	Niet - Weinig - Af en toe **- Meestal – Altijd** Alles is gepatenteerd, wat het automatisch openbaar maakt. En om zoveel mogelijk marketing te krijgen wordt heel veel gepubliceerd op alle niveaus (wetenschappelijk tot populair). Ook open innovatie bij het Holst Centre wordt op het niveau van pre-competitief onderzoek uitgevoerd door de technologieproducenten. (Industrial partnership program)
20.	Niet - Weinig - Af en toe - Meestal - Altijd
21.	Eens per jaar – eens per maand – eens per week – dagelijks – …
22.	Niet - Weinig - Af en toe - Meestal - Altijd
22.	
23.	Niet - Een beetje - Gewoon - Best wel – Heel erg
24.	Dit is een hele gevoelige vraag. In ieder geval is het zo dat er natuurlijk regels zijn die de concurrentie vrij houden. Dus contacten die dit in gevaar brengen door prijsafspraken te maken zullen zo veel mogelijk vermeden worden. Desalniettemin zullen deze mensen elkaar wel eens tegenkomen. In Nederland is er Holland Healthtech, een belangenbehartigende organisatie, waarbij alle medische technologiebedrijven in Nederland aangesloten zijn en daar eens in de zoveel tijd bij elkaar komen. Zij maken wel strenge afspraken over de agendapunten en proberen te focussen op zaken als het Nederlandse gezondheidszorgsysteem, gezamenlijke uitdagingen of het verbeteren van de zorg door ideeën te bedenken om de totale innovatiekracht in Nederland te verbeteren.
25.	**Nooit - Heel soms** - Soms - Vaak – Altijd Die zijn vooral geïnitieerd door onderzoek vanuit de onderzoeksinstituten. Al gebeurt het zo weinig dat ik me er niet bewust van ben.
26.	Niet - Weinig - **Af en toe - Meestal** – Altijd Dit wordt wel actief uitgevoerd door de producenten. Dit laat niet achterwegen dat gebruikers het af en toe nalaten om hier niet actief mee bezig te zijn.
27a.	-
27b.	
27c.	Ministerie van VWS, Raad voor gezondheidsonderzoek (Gezondheidsraad – bepaald welk onderzoek er gedaan moet worden) en andere adviesorganen. Een EMA controleert op klinische utiliteit en veiligheid, maar vergoeding e.d. worden door CVZ en VWS bepaald. In bijna alle gevallen is het zo dat een goedkeuring op het gebied van veiligheid en klinische meerwaarde door de EMA ook goedkeuring van het CVZ krijgt.
28a.	VWS + adviesorganen, medische beroepsgroep
28b.	Patiëntorganisaties, (zorgpersoneel?). Lobbyen vanuit de producent kan je doen door de winst die te behalen is te benadrukken, maar het is erg moeilijk om als producent echt invloed uit te kunnen oefenen. Helaas laat de politiek zich te vaak leiden door belangen van 'minder relevante' partijen en korte termijn perspectieven, i.p.v. te kijken naar harde feiten over de te behalen voordelen en kwaliteit op de lange termijn.
29.	Niet – Niet echt – **Redelijk – Best wel** - Heel erg Europa is wel aan verandering toe. Ieder land heeft zijn eigen, nationale zorgstelsel; soms zelfs op regionaal niveau (Spanje).
30.	Niet – Niet echt – Redelijk – Best wel – Heel erg
31.	Heel lang – lang – normaal – kort – heel kort
32a.	Niet – Niet echt – Redelijk – Best wel – Heel erg
32b.	
33a.	Nee
33b.	
34a.	Ja
34b.	Ze gaan voor een groot deel naar fundamenteel onderzoek en pre-competitief onderzoek. Dit komt voornamelijk uit Brussel. Je bent dan wel verplicht om samen te werken met andere, buitenlandse partijen om het 'Europese tintje' er bij te houden. In Nederland is er het 'topsectorenbeleid' waardoor er geen subsidiegeld

	meer gaat naar de grote bedrijven. De subsidie die er is gaat naar het MKB (De vroegere FES: Frans-economische structuurversterking, wordt niet meer ingezet hiervoor, waar er vroeger wel plek voor was). Er zijn nog wel belastingvoordelen voor bedrijven die R&D uitvoeren. Dit zorgt er alleen niet voor dat er sturing gegeven kan worden naar welk onderzoek dit moet gaan en heel effectief is het ook niet.
34c.	Subsidies helpen wel om nieuwe initiatieven te stimuleren en risico's die daarmee gepaard gaan te verkleinen. Tegenwoordig is het daarom aantrekkelijker om in andere landen dan in Nederland iets op te starten.
34d.	-
35a.	Nooit - Heel soms - **Soms - Vaak** – Heel vaak
35b.	Gemiddeld tot best wel
36a.	Onderzoek Holland Healthtech onder alle leden wijst uit: 150 bedrijven die medische technologieproducten ontwikkelen in Nederland, hier werken 5000 mensen. Ze hebben een omzet van 4 miljard en jaarlijks 6,5% groei. 8-10% van de omzet gaat naar R&D (=320-400 miljoen euro). 80% van de omzet gegenereerd door export.
36b.	Laag – Iets minder – **Gelijk – Iets hoger** – Hoog
37a.	Nooit - Heel soms - **Soms** - Vaak – Heel vaak Dit hangt heel erg af van het soort innovatie: hoe groter de apparatuur (imaging e.d.) hoe meer standaardisatie er is: alle output is gelijk en kan overal op aangesloten worden. Op het gebied van home health care is er juist veel minder standaardisatie, mede door het schaalvergrotingsprobleem voor kleinere partijen. Er zijn wel initiatieven om ook dit meer te standaardiseren (Continua Consortium voor het uniform maken van telehealth). Dit kan op het gebied over protocollen van uitwisseling en codetaal, maar ook nog veel simpeler als apparatuur, voltage, stekkers, etc.
37b.	Nooit – Heel soms – **Soms – Vaak** – Heel vaak
37c.	Ja, met name op het gebied van de kleinere apparaten.
37d.	-
37e.	-
38.	Nooit - Heel soms - **Soms - Vaak** – Heel vaak Hoe groter het apparaat of de technologie er omheen, hoe meer dat dit voorkomt.
39a.	**Nooit - Heel soms** - Soms - Vaak – Heel vaak Dit is vrij lastig omdat alles wat op de markt gebracht wordt beschermd is door octrooien, en daardoor dus vrij moeilijk om dit te kopiëren.
39b.	...
40a.	Geen – bijna geen – een paar – **best wel wat – heel veel**
40b.	De gezondheidszorg kent veel grenzen.
41a.	Geen – bijna geen – een paar – **best wel wat – heel veel**
41b.	Met name beschermd door octrooien maar ook door de grootte van de belangrijke partijen is het veld behoorlijk gepolariseerd.
42a.	Nooit - **Heel soms** - Soms - Vaak – Heel vaak
42b.	
43a.	Nooit - **Heel soms** - Soms - Vaak – Heel vaak
43b.	
44a.	Laag – vrij laag – **gemiddeld – vrij hoog** – Hoog
44b.	
45a.	Niet – Niet echt – Redelijk – **Best wel - Heel erg**
45b.	Alles is gepubliceerd, gemarket en gepatenteerd.
46a.	Niet – Niet echt – Redelijk – **Best wel** - Heel erg
46b.	Complexe nieuwe technologieën met lange en ingewikkelde onderzoekstrajecten
47a.	Laag – middel – **Hoog – universitair – universitair +**
47b.	
48.	Ja
49.	Minimaal invasieve chirurgie
50.	Ultrasound apparaten naar Duitse huisartsen Telehealth in Europa

Interview Maarten Wittop Koning on the ICT-technology sector 28-05-2013	
Nr.	**Answer**
1a.	Niet - Weinig **- Af en toe** - Meestal - Altijd
1b.	In principe staan ze wel open voor nieuwe technologieën, maar er zijn weinig 'early adopters'. Het is een vrij behouden beroepsgroep. Er is wel interesse vanuit de zorgverleners om processen te verbeteren, maar het zijn wel individuele partijen (veel specialisten zijn zelfstandig met hun

	eigen bedrijf). En de zorgverleners functioneren als 'ambassadeur' van technologie naar patiënten toe. Top down ingrepen werken niet, maar bottum up kost veel tijd en energie. Patiënten hebben 'geen stem', als in, het zijn allemaal individuen, die moeilijk te overtuigen zijn. Koepelorganisaties zijn hier niet in staat om wel die stem samen te voegen. Daarbij komt dat de gemiddelde patiënt ook niet heel vooruitstrevend is.
2a.	Niet - Weinig - Af en toe **- Meestal** - Altijd
2b.	De nieuwe innovaties hebben een business case nodig, dus investeringen worden gespreid over een potentiele populatie. De ICT markt is behoorlijk commercieel ingericht vooralsnog. Ook de acceptatie bij medische professionals zal sneller gaan als het op een grotere groep van toepassing is.
3a.	Niet - Weinig - Af en toe **- Meestal** - Altijd
3b.	De beschikbaarheid en betrouwbaarheid van apparatuur moet rechtevenredig zijn met de ernst van een ziekte. (Oftewel, hoe ernstiger een ziekte, hoe meer open mensen staan voor nieuwe technologie die daar beter bij kan ondersteunen).
4.	Het eerste criterium is of je een innovatie vergoed wilt hebben en of het product gecertificeerd moet worden. Productie en afzet zouden met het overzichtelijke aantal partijen (paar 1000 huisartsen en 100 ziekenhuizen) geen belemmering hoeven te zijn. Zonder goedkeuring zou een product vanaf het idee binnen een paar maanden al op de markt geïntroduceerd kunnen worden. Alleen het vergoedingssysteem kan het proces vertragen. Dit is sterk afhankelijk van de relatie met een zorgverzekeraar. Dan kan het gelijk 1,5-2 jaar duren. Dit gaat dan per verzekeraar. Hier staat de grens tussen lifestyle en zorg onder spanning. Hoe meer iets naar zorg neigt, hoe betrouwbaarder het moet zijn, maar hoe langer implementatie gaat duren.
5a.	Niet - **Weinig** - Af en toe - Meestal - Altijd
5b.	Zorgverleners handelen veel op basis van vertrouwen en menselijk contact. Ze moeten wel een 'beeld' hebben bij een bepaalde partij. Ze zijn minder vatbaar voor een 'ministerie' of een 'rapport', of iets anders groots. Over het algemeen zijn ze minder snel geneigd om van derden iets aan te nemen.

6a.	Niet - Weinig - Af en toe - **Meestal** - Altijd
6b.	Adoptie van een gerenommeerd persoon helpt bij de verbreedde acceptatie, maar het blijven wel persoonlijke beslissingen.
7a.	Niet - Een beetje - Gewoon - **Best wel – Heel erg**
7b.	Door de vertrouwensband helpt wel dat mensen sneller iets van je 'aannemen'.
7c.	
8a.	Geen - Een beetje – Gewoon - **Best wel - Sterk**
8b.	Het is een gesloten markt. Voor buitenstaanders kan het tegenvallen om innovaties te lanceren zonder een netwerk. (Gunfactoren spelen een hele grote rol). Een voorbeeld van de apothekers markt die opgedeeld is in 3 stukken, waarbij je, als je bij de 1 zit, je niet meer bij de anderen aan tafel kan komen. Er zitten hele strakke netwerken in die elkaar beïnvloeden en daar moet je goed op de hoogte zijn van welke personen invloedrijk zijn. Het wordt versterkt omdat innovaties afhangen van individuen (medisch specialisten). Het verhaal rondom het product moet ook toegespitst worden op verschillende belangen die in grotere organisaties (ziekenhuizen) allemaal belangen hebben (de financiën man, de medische professor, de IT specialist, de directeur, etc.).
8c.	
9a.	Geen – **Een beetje – Gewoon** – Best wel – Sterk
9b.	Van oudsher zijn er een aantal grote partijen die in het verleden posities heeft verworven. KPN is daar misschien een voorbeeld van. Maar partijen als B/Pink rokade healthcare en TSS software hebben 80% van de huisartsenmarkt. Chipsoft heeft 80% van alle ziekenhuizen in Nederland. Zij specialiseren zich op 1 niche/onderdeel in het digitale proces. Deze partijen streefden altijd naar een soort 'marktdominantie'. Deze partijen hebben nog steeds invloed op de innovatieve ontwikkelingen in de zorg. Wel is te zien dat er langzaam kleinere partijen op staan die complementair of additioneel kleine niches zoeken binnen de hele grote systemen (voorbeeld: oncologisch overleg). Deze kleine partijen hebben wel ondersteuning nodig van investeerders of 'beschermers'. Er zijn zo goed als geen internationale partijen op de markt. Dit heeft te maken regelgeving en cultuur. Er is een voorbeeld: EPIC, en een Duits huisartsensysteem
10.	Continuïteit, service, kwaliteit/werkzaamheid, maar die overtuiging

	gebeurd op menselijk niveau. In principe moet je overal persoonlijk langs en daar vertellen over je product. Kwaliteit van service ligt bij kleinere bedrijven veel meer de nadruk op persoonlijkheid. Hoe groter het instituut, hoe hoger de eisen aan continuïteit.
11a.	Niet - Weinig **- Af en toe - Meestal** – Altijd
11b.	Innovatie in de ICT ligt meer op het slim toepassen van een bepaalde techniek of het combineren van bepaalde apparaten met gekoppelde acties. Hiervoor zijn prototypen minder hard nodig. Het zijn vooral pilots om te kijken of deze werken
11c.	-
12a.	Niet - Weinig - Af en toe - **Meestal** - Altijd
12b.	Niet - Een beetje - Af en toe - **Best wel - Heel erg**
13.	-
14.	Producenten van ICT, ziekenhuizen, specialisten/zorgverleners, zorgverzekeraars, belangenverenigingen, gemeenten in toenemende mate, overheidsorganen.
15.	Tussen producenten en gebruikers zijn het dus hele persoonlijke relaties. Met zorgverzekeraars kan dit verschillen. Als een product in aanmerking komt voor vergoeding, ga je individuele afspraken maken met zorgverzekeraars en de NZa. Het zijn geen vragenlijsten of statische processen. Het zijn wel discussies die gevoerd worden met mensen.
16.	Helemaal niet – Niet echt – **Een beetje – Behoorlijk – Heel erg**
17.	-
18a.	Kennis van zaken over processen. Je hebt namelijk te maken met professionals waarmee je wel een goede discussie moet kunnen voeren. Daarnaast is een groot relatienetwerk om naar binnen te komen bij bepaalde klanten.
18b.	
18c.	
19.	Niet - Weinig - **Af en toe - Meestal** – Altijd
20.	Niet - **Weinig** - Af en toe - Meestal – Altijd Het is nog beperkt, maar dat heeft ook te maken met de grote traditionele partijen die de markt voor zichzelf wilde houden. Hierin probeerden zij hun eigen standaarden te ontwikkelen (vb: 6 verschillende DiComstandaarden). Een initiatief van de overheid Nictiz, is begonnen om standaarden in deze sector op te zetten.
21.	-
22.	Niet - **Weinig** - Af en toe - Meestal - Altijd
22.	Er wordt niet echt geluisterd naar 'top down' beleid. Het maakt het soms misschien wel moeilijker om iets voor elkaar te krijgen, zeker bij specialisten. Hoe hoger opgeleid mensen zijn, hoe moeilijker het vaak is om ze te overtuigen. Bij instellingen heeft wet- en regelgeving wat meer effect. Andersom, als je de specialist mee hebt, wordt het wel makkelijker. Stichtingen en belangenorganisaties hebben buiten 'marketing/media-aandacht' weinig invloed.
23.	Niet **- Een beetje - Gewoon** - Best wel – Heel erg
24.	Ja, dit blijven wel zakelijke contacten. Ze hebben op die manier wel invloed op bepaalde processen.
25.	Nooit - **Heel soms** - Soms - Vaak – Altijd
26.	Niet - **Weinig** - Af en toe - Meestal – Altijd Als er wel bekendheid is, werkt dat zeker mee in de innovatieve kracht. Het moet wel complementair zijn.
27a.	-
27b.	
27c.	Overheid (het Rijk)/Ministerie van VWS, NZa, gemeenten, (provincies die hebben deels invloed d.m.v. subsidies). Zorgverzekeraars en ziekenhuizen bepalen tegenwoordig een hoop zelf.
28a.	
28b.	Een partij als KPN heeft een lobbyist in dienst. Patiëntenorganisaties vinden hun bestaansrecht in invloed uitoefenen op de politiek.
29.	Niet – Niet echt – Redelijk – **Best wel - Heel erg**
30.	Zie 3a. De politiek is vaak wel erg incident gedreven. De vraag is alleen in hoeverre de overheid nog directe invloed heeft op wat wel en niet vergoed wordt.
31.	Heel lang – lang – **normaal** – kort – heel kort
32a.	Niet – Niet echt – Redelijk – **Best wel –** Heel erg
32b.	Het belemmerd bedrijven om nieuwe technologie te ontwikkelen, omdat ze niet zeker zijn of ze door de bureaucratische rompslomp heen komen.
33a.	Nee
33b.	-
34a.	Ja, op alle niveaus. Landelijke regelingen (CA-regelingen) die gaan over de kosten van ICT-inzet in de zorg. Regionaal niveau zijn er meerdere initiatieven om de zorg dichterbij brengen met behulp van ICT.
34b.	

34c.	Er wordt veel gekeken naar projecten die bij de start al 'bewijzen' dat ze niet rendabel zullen ze zijn en waar niet genoeg over is nagedacht. Het subsidiegeld wordt dan gebruikt om de pilotfase te betalen. Daarmee is deze subsidie niet effectief. Daarnaast gaat er ook veel geld naar overheadkosten. Dit is wel heel lastig om dit goed te doen. Maar op deze manier worden ongezonde ideeën in leven gehouden.
34d.	-
35a.	Nooit - Heel soms - Soms - **Vaak** – Heel vaak Maar de snelheid van de zorg is niet zo hoog.
35b.	Nee, alles bestaat al, het lastige is vaker om het procesmatig goed te implementeren. De ethische vraagstukken zijn vaak complexer.
36a.	-
36b.	-
37a.	Nooit - Heel soms - **Soms - Vaak** – Heel vaak Afgedwongen door grote partijen en soms door overheid.
37b.	Nooit – Heel soms – **Soms** – Vaak – Heel vaak
37c.	Ja
37d.	-
37e.	-
38.	-
39a.	Nooit - Heel soms **- Soms** - Vaak – Heel vaak Sommige technologieën kunnen wel beschermd worden door patenten. Het is wel een gezonde markt.
39b.	Ja
40a.	Geen – bijna geen – een paar – **best wel wat** – heel veel
40b.	Zie 8a.
41a.	Geen – bijna geen – een paar – **best wel wat – heel veel**
41b.	Zie 8a.
42a.	Nooit - **Heel soms - Soms** - Vaak – Heel vaak
42b.	De beroepsgroep blijft behoorlijk conservatief
43a.	Nooit - Heel soms **- Soms** - Vaak – Heel vaak
43b.	Zie 8a./9a.
44a.	Laag – vrij laag – **gemiddeld – vrij hoog** – Hoog
44b.	
45a.	Niet – Niet echt – Redelijk – **Best wel** - Heel erg
45b.	-
46a.	**Niet – Niet echt** – Redelijk – Best wel - Heel erg
46b.	-
47a.	Laag – **middel – Hoog** – universitair – universitair +
47b.	-
48.	
49.	KPN: Trees
50.	

11. Appendix D – Actors in Dutch Healthcare

European Medicines Agency (EMA)
This is a decentralized body of the European Union with headquarters in London. Its main responsibility is the protection and promotion of public and animal health, through the evaluation and supervision of medicines for human and veterinary use. The EMA is responsible for the scientific evaluation of applications for European marketing authorisation for medicinal products. (http://www.ema.europa.eu/)

'College ter Beoordeling van Geneesmiddelen' (CBG) or Medicine Evaluation Board
The medicine evaluation board evaluates and monitors the efficacy, risks, and quality of human and veterinary medicinal products in The Netherlands. It also assesses the safety of novel foods for human consumption. The board is made up of doctors, pharmacists, and scientists and has autonomous power to take decisions on the availability of these medicinal products. (http://www.cbg-med.nl/)

'College voor Zorgverzekeringen' (CVZ) or Healthcare Insurance Board
The Healthcare insurance board co-ordinates the implementation and funding of the Health Insurance Act ('Zorgverzekeringswet': Zvw) and the General Act on Exceptional Medical Expenses ('Algemene Wet Bijzondere Ziektekosten': AWBZ). They examine whether the basic package of care provided by the Health Insurance Act and the AWBZ is accessible and affordable, and whether it continues to provide the care that is regarded necessary. (http://www.cvz.nl/)

'Gezondheidsraad' (GR) or The Health Council
The Health Council of the Netherlands is an independent scientific advisory body whose task it is to advise Ministers and Parliament in the field of public health. Ministers ask the Health Council for advice on which to base policy decisions. In addition, the Health Council has an "alerting" function, which also allows it to give unsolicited advice. The purpose in both cases is the improvement of public health. Additionally the Health Council delves into the relationship between health and nutrition, and health and environment. (http://www.gezondheidsraad.nl/)

'Nederlandse Federatie van Universitair Medische Centra' (NFU) or Dutch Federation of Medical University Centres
The NFU will act as a knowledge institute for health care, when it comes to patient care, medical research and innovation, education and training in the Netherlands. As a representative of the UMC's in public and national interest, the NFU takes part in several consultative and parliamentary bodies at country level. (http://www.nfu.nl/)

'Nederlandse Vereniging van Ziekenhuizen' (NVZ) or Dutch Hospitals Association
NVZ primarily focuses on the collective representation of its members' care-related, social and economic needs. These members include all general hospitals, as well as non-affiliated institutions in the Netherlands, such as asthma centres, audiological centres, cancer centres, radio-therapeutic institutes, convalescence centres, and dialysis centres. It is NVZ's objective to create frameworks for its members, which allow hospitals to respond flexibly to changes in the demand for care. A considerable part of the association's activities therefore focuses on helping create conditions that are compatible with the sector. NVZ achieves this objective by means of policy development, and by lobbying and consulting with relevant parties in the field. (http://www.nvz-ziekenhuizen.nl/)

'Stichting Topklinische Ziekenhuizen' (STZ) or Association of tertiary medical teaching hospitals
The STZ is an association of cooperating Tertiary Medical Teaching Hospitals. STZ hospitals together provide an effective, efficient, and

interrelated organization of medical (specialist), nursing, and paramedical courses, tertiary and specialized care, and applied research. (http://www.stz-ziekenhuizen.nl/)

'Rijksinstituut Volksgezondheid En Milieu' (RIVM) or National Institute for Public Health and the Environment

The National Institute for Public Health and the Environment (RIVM) is a recognised leading centre of expertise in the fields of health, nutrition, and environmental protection. RIVM works mainly for the Dutch government. (http://www.rivm.nl/)

'Nederlandse Zorgautoriteit' (NZa) or Dutch Healthcare Authority

The Dutch Healthcare Authority (NZa) is the supervisory body for all the healthcare markets in the Netherlands. The NZa supervises both healthcare providers and insurers; in the curative markets as well as the long-term care markets. (http://www.nza.nl/)

'Ministerie van Volksgezondheid, Welzijn en Sport' (VWS) or Ministry of Health, Welfare and Sport

The Ministry of Health encourages people to live healthy, exercise more, smoke less, drink moderately, have safe sex, and adopt a healthy diet. People with health problems should be able to consult their GP, a hospital, or other care providers as whenever needed. They have fundamental right to health care. Together with health insurers, care providers, and patients' organisations, the Ministry ensures that enough services are available and people have enough choice. (http://www.rijksoverheid.nl/Ministerie_VWS/)

'Zorgverzekeraars' (ZV) or Health Care Insurers

Health Care Insurers (ZV) are private companies that must give execution to two laws:

1. Implementation Law Exceptional Medical Expenses Act (AWBZ)
2. Implementation (additional) health insurance (in Health Insurance Act): Every Dutch citizen is obliged to be insured Starting point: obligation of HCI to provide healthcare Health insurer has freedom to contract. (http://www.zn.nl/)

'Centraal Begeleiding Orgaan' (CBO) or Dutch Institute for Healthcare Improvement

The Dutch Institute for Healthcare (CBO) is active in the area of quality and healthcare. In doing so, the CBO pays attention to the process of care, and mostly to patients. The CBO organization supports and coaches healthcare providers in achieving quality improvement in their care, by developing evidence based national guidelines. (http://www.cbo.nl/)

'Nederlandse Huisartsen Genootschap' (NHG) or Dutch College of General Practitioners

The NHG is an independent organization, but there is a close collaboration with the Dutch Association of General Practitioners (LHV), the union of GP's. Together, the NHG and the LHV have taken the initiative to implement a quality policy in general practice, aiming to achieve good quality and responsible organization of the care provided by GP's. (http://www.nhg.org/)

'Nederlandse Patiënten en Consumenten Federatie' (NPCF) or The Federation of Patients and Consumer Organisations in the Netherlands

The NPCF aims to strengthen the position of patients and consumers of health care by promoting their common interests by working with government, policy makers in national, regional, and local institutions, professional organisations and providers of health care (home care, hospitals) and health insurance companies. (http://www.npcf.nl/)

'Farmaco Therapie Overleg' (FTO) or Pharmacotherapy

The goal Pharmacotherapy Talk (FTO) is that doctors and pharmacists at

the local level agree on the prescription of medicine. These agreements aim to rationalize the use of medicines.

'Raad Volksgezondheid Zorg' (RVZ) or Council for Public Health and Care
The Council for Public Health and Care is an independent advisory body to parliament and government. It is committed to the health of citizens and the quality and accessibility of health care. (http://www.rvz.net/)