

An analysis of the creation of a sustainable business model for a start-up in the e-health industry in the Netherlands

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ABSTRACT

There is a low degree of e-health technologies which are implemented within the health care industry in the Netherlands. Limburg first identified this problem and in cooperation with Gemert-Pijnen they created an holistic approach' foundation to tackle this problem (2011). The essential difference with other approaches for a successful implementation was the use of business modelling in this approach, as business modelling is the bridge between health technologies and a managerial approach for the implementation of these technologies. In this paper an analysis is performed how external and internal factors influence the development of a sustainable business model for a start-up in the e-health industry. Therefore, three start-ups: Umenz, JouwOmgeving and SkinVision were interviewed. Due to different focusses in their product development, the start-ups' business models and implementation showed different results. The results show that the more developed a business model is, the more a start-up is able to act on this business model and implement their technology in the industry. The difference in business model development are because of differences in strategy innovation capabilities and resource capitalization capabilities, thus internal factors. The strategy innovation capabilities show that a broad focus causes a start-up to be less adaptable to the market and it takes longer to develop an entire business model. The resource capitalization capabilities show that a well-thought out planning is necessary to integrate both the development and marketing of technologies into one start-up. The financial resources are than necessary to act on this planning. The networking capabilities could help as a supporting capability once a business model is under developed. The external analysis shows that external resources are less important for the development of a business model than internal factors. However, these are more thresholds to consider. Furthermore, they could pose future opportunities during the technology implementation process. Therefore, what can be concluded is that internal capabilities are more of influence on the development of a sustainable business model than external factors.

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11th IBA Bachelor Thesis Conference, July 10th, 2018, Enschede, The Netherlands.

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Keywords

Business models, e-health, start-up, canvas, internal capabilities, external environment

1. INTRODUCTION

The Netherlands aims to secure a position in the top-five of the world's most competitive economies.ⁱ The strategy of the Netherlands is to achieve this position by focussing on their top-sectors. These sectors are showing major growth potential and these are sectors in which the Netherlands is already showing solid results.ⁱⁱ Life sciences is one of the nine top sectors in which the Netherlands already has a global leading position. "Medical technology is any technology used to save lives in individuals suffering from a wide range of conditions."ⁱⁱⁱ and therefore an important part for the development in life sciences.

The opportunities for technology development in the medical sector are seven to ten percent, which supports the statement of the Netherlands that there is a lot of potential in this sector. (Bestetti, 2009) These opportunities are also confirmed by a research which showed that in 2016 an increase of 200 percent took place in the number of Dutch med-tech start-up funding deals.^{iv} One of the sectors in which the increase in start-ups is made clear is in the e-health industry.^v (KPMG, 2017) E-health is described as the digital application in the health sector, where through the use of information- and communication technologies a support or improvement in the health sector can be realized.^{vi} The leading definition in the literature is "an emerging field in the intersection of medical informatics, public health and business, referring to health services and information delivered or enhancing through the Internet and related technologies." (Eysenbach, 2001, p.1) Furthermore, E-health helps to improve quality and effectiveness of health care services and e-health proposes opportunities which will make high quality health care accessible and affordable in the future. (van Limburg, 2016) (Nijland, 2011) Other advantages of e-health are timesaving in the health process, more insights in your own health and less administrative burdens. (Dutch government, 2017) E-health in the Netherlands has a high potential especially as the Netherlands has a leading role in ICT-infrastructure.^{vii} However, if the Netherlands is compared to other countries who are making use of e-health, than the Netherlands is underperforming in implementing e-health technologies in the health care.^{viii} Dutch organizations still have several issues in order to create a sustainable implementation for their e-health technology. There are several recurring problems, such as e.g. there is a lack of cost effectiveness studies, and these problems are caused by a lack of attention to the implementation process of the e-health technologies. (van Limburg 2016).

In order to overcome these recurring problems a standardized framework is created for the design, development and implementation processes of the technologies. This framework is able to consider all the needs of all the stakeholders, together with the ability of a framework to show if a technology is sustainable. (van Limburg, 2016) These aspects of this framework were taken into account and evolved into a holistic approach' foundation which should focus on the evaluation and implementation of e-health technologies. (see Figure 2.) (van Gemert-Pijnen, et al., 2011) This holistic approach' foundation is co-created with multiple stakeholders, under which the end users, to make sure that this foundation fits their needs and behaviour. (van Gemert-Pijnen, et al., 2011)

The holistic approach' foundation differentiates it from other implementation approaches by integrating business modelling, as business models are the bridge between health technologies and a managerial approach to implement an innovation. (van Limburg, 2016) Business modelling is of additional value of the implementation process as it provides the holistic view on the approach' foundation by integrating the social, economic and

organisational infrastructures around an eHealth technology into the implementation process. (van Limburg, 2016) Furthermore, what business modelling adds on the foundation is that it can be used as a marketing guide on how to promote the innovation once it is fully developed, or even better to prevent an innovation from developing if the business model predicts no demand for the innovation. (van Limburg, 2016) Thus, from an early phase in the development and implementation process, a business model can already be of essential importance. It is value-driven process which could help to identify the critical factors for a sustainable implementation. (van Gemert-Pijnen, et al., 2011) In order to develop a sustainable business model an organisation is dependent on their internal capabilities and on the resources available from the external environment. Differences in the use of these resources could cause differences in organization's business models. (Cavalcante, 2011)

Therefore, to increase the Netherlands' e-health sector performance, it would help to focus on a better integration of business models into the implementation process of an e-health technology, as these business models would support the overall implementation and enables the innovation to become more sustainable. There are still too little researches done on how to establish an effective business model for the e-health business and how to implement this. (Zilgalvis, Jungmann, 2015) Which leads us to the main research question of this thesis: *How do internal and external factors influence the development of a sustainable business model for a start-up in the e-health industry?* This research will focus on three start-ups within the e-health sector. All organisations are analysed on how their business model is created with use of the internal and external resources available and to which extent every aspect of a business model is implemented during the development process.

The first start-up I analysed is *Umenz*. Umenz' goal is to support the health care and the decision making process of patients by the use of a digital health platform. Patients are helped in obtaining a more active role in their decision making process and obtaining more responsibility for their own health process. Umenz' focus is on guiding patients during their health care process.^{ix} The second organisations which I analysed is *JouwOmgeving*. *JouwOmgeving* is a start-up which provides a secured online platform for a more integrated health process. It is a central communication platform for all the stakeholders during the health process and supports this process by virtual health treatments and online work processes, their focus is on the mental healthcare.^x The third organisation which I analysed is *SkinVision*. *SkinVision* is a start-up which could make a risk assessment of skin spot through the use of a camera on your phone. Based on this risk assessment users can make an appointment with the doctors. This eliminates risk free spots to be assessed by doctors, which saves time.^{xi}

2. THEORETICAL FRAMEWORK

2.1 Business models

"A successful company is one that has found a way to create value for customers—that is, a way to help customers get an important job done." (Johnson, Christensen, Kagermann, 2008, p.52) A business model demonstrates how a business creates and delivers value to customers. (S. Voelpel, Leibold & B. Tekie, 2004) (Wirtz & Lihotzky, 2003) Therefore, a business model is necessary to become successful for a company. "A business model also outlines the architecture of revenues, costs and profits associated with the business enterprise delivering that value." (Teece, 2010, p.173) Furthermore, a well implemented business

model could also give an organisation a competitive advantage. (Teece, 2010) Thus, it can be stated that a business model “reflects management’s hypothesis about what customers want, how they want it and what they will pay and how an enterprise can organize to best meet customer needs and get paid well for doing so.” (Teece, 2010, p. 191). As there is a large variety in definitions of a ‘business model’, and it is still not possible to find an anonymously shared meaning of a business model, Chesbrough and Rosenbloom came up with six specified functions for a business model. (M. Sorrentino, M. Smarra, 2015) (Chesbrough & Rosenbloom, 2002) These are functions which a definition of a business model should at least contain of in order to give a full representation of what a business model should be. These functions are:

- “to articulate the value proposition, [...]”
- to identify a market segment, [...]
- to estimate the cost structure and the profit potential for producing the offering, given the value proposition and the value chain structure chosen.
- to define the structure of the value chain within a firm required to create and distribute the offering, and determine the complementary assets needed to support the firms position in this chain
- to describe the position of the firm within the *value network* linking suppliers and customers, including identification of potential complementors and competitors.
- And to formulate the *competitive strategy* by which the innovating firm will gain and hold advantage over rivals.” (Chesbrough & Rosenbloom, 2002, p. 533)

An increased understanding of the essence of business models should help our understanding of the nature of the business itself, together with the role of entrepreneurs and managers in the economy and society. (Teece, 2010) An increased understanding of the essence of business models should also help an organisation to better understand some of the functions of a business model. (Teece, 2010) Chesbrough also emphasized the importance of a business model after his research by the statement that “a mediocre product with a good business model yields more value than a good product with a mediocre business model.” (Chesbrough, 2010, p.354) Therefore, the importance of business models in any industry are clear.

Now that the concept and function of a business model is defined, a decision needs to be made which specific business model to use in order for organisations to understand which aspects are of importance to this business model. There are multiple business models which try to describe the elements of a successful, and therefore sustainable business model. Johnson, Christensen & Kagermann (2008) and Osterwalder & Pigneur (2004) both have described a model with four elements which form the building blocks of any business. Johnson, Christensen and Kagermann’s customer value proposition and profit formula define value for the customer and the company, this is comparable with Osterwalder & Pigneur’s product innovation and customer relations. Furthermore, Johnson, Christensen and Kagermann’s key resources and key processes describe how this value will be delivered to both the customer and the company, this is in accordance with Osterwalder & Pigneur’s infrastructure management. Therefore both business models are both well designed and address the core concept of how to create and deliver value to customers. (Johnson, Christensen and Kagermann, 2008) (Osterwalder & Pigneur, 2004)

In 2005, Osterwalder & Pigneur continued on their own research and created a business canvas. They created this canvas in a way

that every business model can be based on it. The overall idea of this canvas is to create a standardized way to create and analyse business models. (Osterwalder & Pigneur, 2010) And because of the visual representation of this business model, it makes it easier to tell the story behind the business model. (Coes 2014) Osterwalder & Pigneur continued to improve this canvas to the point where they designed a canvas with nine standardized building blocks. (Osterwalder & Pigneur, 2010) This framework describes the entire value creation logic and is a guide for making sure that all nine aspects necessary for value creation are addressed. (van Limburg 2016) Therefore, the difference with other business models is that this canvas is more detailed, while it still includes all the important functions of a business model. Therefore, because this canvas makes sure that all nine specific aspects of value creation and delivery are addressed in a standardized way, this paper will make use of the 2010’s Osterwalder & Pigneur canvas. (see figure 1.)

As mentioned earlier, the four pillars (key-elements) for a successful business model: product innovation, customer relations, infrastructure management and financials, can be identified in the canvas. (Osterwalder & Pigneur, 2004) This canvas has separated these four pillars in even more specific blocks. The three blocks on the upper *left* side deal with the required organizational aspects and are in accordance with infrastructure management. The three blocks on the upper *right* side deal with the customer value delivery and are in accordance with customer relations. The two blocks at the bottom of the canvas are the financial aspects with the costs and profits generated from the value you have created. The middle block is value proposition is in accordance with the product innovation, which describes the aspect of your business where your derive your value from. (Osterwalder & Pigneur, 2010)

The most state of the art canvas consists of the following 9 building blocks: customer segment, value propositions, channels, customer relationships, revenue streams, key resources, key activities, key partnerships and cost structure. (Osterwalder & Pigneur, 2010) And these building blocks are the aspects which are of most importance for organisations to understand and to have an overview of.

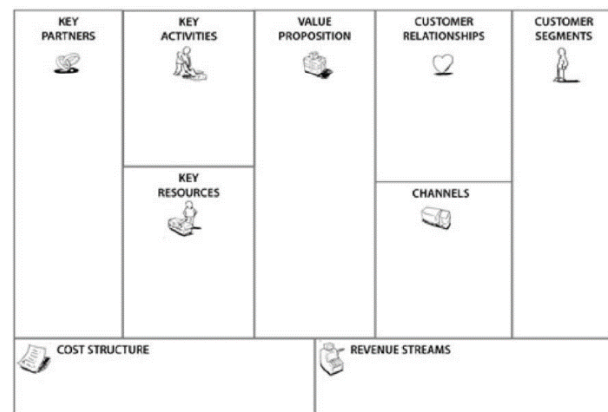


Figure 1. Osterwalder & Pigneur (2010) Canvas

It is of importance to understand the creation part of a business model as the purpose of this research is to analyse start-ups’ creation and implementation of a business model in the e-health industry. The creation of a business model is referred to as the development of an idea into a concrete business venture. (Cavalcante, 2011) One of the core factors for business model creation is continuous learning, which leads to a continuous stream of incremental changes in your venture. (Cavalcante, 2011) The second critical factor is the collaboration with other organisations as collaborations with other organisations could

lead to new opportunities for creating a business model. (Cavalcante, 2011) Furthermore, the third factor is that managers should support the creation and development of core processes in order to design and create a particular type of business model which has their preference. The difference in these business models could be in the focus of such a business model. Managers are able to focus more on the service towards customers, i.e. channels and customer relationship, or focus more on the product itself (i.e. value proposition). (Cavalcante, 2011) These three critical factors combined are of a major influence on the business model creation process.

2.2 Business models in the e-health industry

Many e-Health technologies do not succeed to become a sustainable innovation. (van Gemert-Pijnen 2011) There are eight recurring problems in the e-health industry which cause this:

- “Currently established financial structures slow down innovation.
- Necessary legislations for modernizing health care lag behind.
- Involved parties are reluctant and uptake remains low.
- eHealth development focuses too strongly on engineering-driven solutions.
- eHealth technologies are deployed in a fragmented fashion and have poor scalability.
- The number of stakeholders and dependencies cause complexity.
- There is a lack of cost-effectiveness studies.
- eHealth research tends to focus on finding clinical evidence in terms of health outcomes, [...]” (van Limburg, 2011, p.2)

These problems can be attributed to a lack of attention to the development and implementation of e-health technologies. (van Limburg et al, 2011) Furthermore, it is stated that the implementation of e-health technologies is often overlooked or underestimated. (van Limburg et al, 2011) The problem can be associated with the triple focus of a business model. “A business model describes the rationale of how an organisation creates, delivers and captures value.” (Osterwalder & Pigneur, 2010, p.14) In the e-health industry the innovators emphasize on the ‘creating’ aspect of value. However, where the innovators are able to create value, they often lack the ability to deliver it. Which automatically means that it also fails to capture the value as the innovations are often not sustainable enough to survive. (van Gemert-Pijnen, et al. 2011)

In order to overcome these obstacles *van Gemert-Pijnen* created an holistic approach’ based on a theoretical background for the development, evaluation, and implementation of e-health technologies. (See figure 2.) (van Gemert-Pijnen, et al., 2011) This framework is based on four principles which an innovator should understand in order to have a successful technology implementation. These four principles are prototyping, the understanding of user requirements and value drivers, and business modelling. These principles were combined and converted in five specific phases in order to describe the development and implementation process of an e-health technology. These phases are contextual inquiry, value specification, design, operationalization and summative evaluation. The contextual inquiry and value specification are both focussed on the user’s needs and how to translate these into user requirements for the innovation. During both phases stakeholder involvement can be used to assess the user needs and value drivers. The value specification process is based on the contextual inquiry and translates these needs into requirements in order to realize the values. Furthermore, during this phase there is a specific focus on goal setting. The design and operationalization phases are both further than the research phase and focus on the actual design and implementation of the e-health technology. The design phase refers to transforming the values and user requirements into prototypes. The operationalization is more focussed on the actual implementation of these prototypes, which is concerned with the introduction and adoption of the technologies in the industry. The summative evaluation is after the implementation and focusses on how the technology is being used and what its effect is. (van Gemert-Pijnen, et al., 2011) The difference with other frameworks in this sector is the presence of business modelling in this framework. This holistic approach’ foundation ensures that the implementation of the e-health technologies are interwoven with business models, as business models are the bridge between health technologies and a managerial approach to implement an innovation. (van Limburg, 2016) Therefore, business models will be analysed for this paper.

In order to let the business model become a success, organizations should start developing a business model at the start of the technology implementation. “Many researchers assume that implementation is an ex-post activity and start preparing implementation when a technology is nearly finished” (van Limburg, 2016, p.21) This is supported by the fact that business models in the e-health could even identify the critical factors of a technology before even collaborating with stakeholders. (N. Nijland, 2011) A barrier for the innovations are often the innovations *itself*, where innovators tend to focus too much on their own innovation and fail to investigate on the need for it or the existence of competing ideas. (E. Herzlinger, 2006)

Holistic approach' foundation

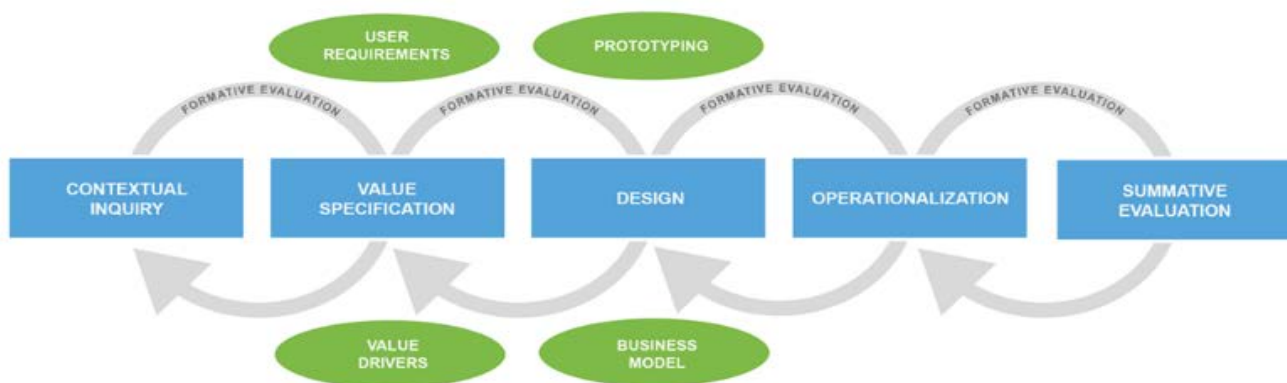


Figure 2. Business modelling influences the theoretical background

At a later phase of the implementation this might lead to a rising awareness of an innovator that there is little demand for its innovation. By developing a business model in the earlier phase of the implementation this phenomenon will be prevented. The focus on business modeling does not mean that innovators should put less attention to their innovation development. The challenge is to focus on your competitors and other environmental factors, as well on the technical innovation itself. As the challenge still remains to keep the value creation central to the development of the e-health technology. (N. Nijland, 2011)

Additionally, it is shown that successful implementations of e-health technologies are caused by a sustainable profit combined with a well-defined value proposition. (Mettler and Euricht, 2012) Therefore, a successful implementation is caused by a value-driven process. Business modelling is a suitable tool to improve the implementations of e-health technologies, as “Business modeling is a value-driven process and, as such, it is not simply a business model but an extensive process through which early opportunities for an eHealth technology are explored, assessment is made of what is required, a case-specific business model is developed, and the said technology is accordingly implemented.” (M. van Limburg et al. 2011, p.4) Furthermore, innovative business models, particularly those that integrate health care activities, can increase efficiency, improve care, and save consumers time. (E. Herzlinger, 2006) Therefore, business models contribute to make the approach more holistic. (van Gemert-Pijnen, et al. 2011)

Once an organization has developed a sustainable business model, this business model can be integrated within the described holistic approach. “This approach will help organizations with the development of eHealth technologies as it integrates persuasive health technology theories with a managerial approach (business modeling) to improve the uptake and impact of eHealth technologies in practice.” (van Gemert-Pijnen, et al. 2011, p.10) However, as there are still too little researches done on how to establish an effective business model for the e-health business and how to implement this, this paper will analyse how internal and external factors influence the development of these business models. (Zilgalvis, Jungmann, 2015)

2.3 Internal resources on the development of a business model

In order to analyse the development a sustainable business model in the e-health sector, multiple factors need to be assessed. Both internal and external factors need to be analysed in order to see how the development of a sustainable business model is influenced. Internal factors are the resources, capabilities and core competencies available to develop a sustainable business model. Therefore, with resources is meant everything which could be thought of as a strength or weakness of a given firm.” (Wernerfelt, 1984, p.172) Therefore, internal resources are a start-ups’ marketing, employees, operations/facilities and finances. (H. Wehrich, 1982) According to the resource-based view, resources are necessary to create a product and deliver this towards the end users. (Wernerfelt, 1984) These internal resources are also of importance as a strong internal fit can compensate the dynamic external environment. (Demil & Lecocq 2010) As start-ups are not able to develop every resource and activity in-house, a start-up needs to collaborate with a wide range of partners to develop their technology and to introduce it to the market. (Oukes & von Raesfeld, 2016) Which means that an important factor of their resources are their partners and how a start-up values their relationship with them. (Arino & de la Torre, 1998) A crucial element to consider, is that resources by themselves do not create value. An organization should have the capabilities to develop a combination of resources which

determines the value created. As a start-up often lacks these capabilities, the value of a start-ups’ resources are also based on the connection with resources of other organisations. (Oukes & von Raesfeld, 2016) Which makes a start-up also dependent on them. (Hakansson et al., 2009) Therefore, a start-up should realize how to benefit the most of the resources and capabilities of other organisations. (Hakansson & Ford, 2002) As mentioned before, a start-up is dependent on the connection with resources of other organisations. The connection of resources can also be described as the process of transferring knowledge and technology between these organisations. (Battistella et al. 2015) The process of transferring this knowledge and technology is dependent on six aspects: the actors involved, the relationship between them, the object being transferred, the channels and mechanisms of transfer and the reference context. (Battistella et al. 2015) As it is proven that sharing knowledge and technology is contributing to the value creation of an organisation, and these previously mentioned factors are all individually able to influence the process of knowledge transfer, it is of importance for start-ups to involve and analyse every factor within the relationship to benefit the most of other organisations within their own value creation process. All the resources and capabilities identified can be separated under three main categories: strategy innovation capabilities, resource capitalisation capabilities and networking capabilities. (Battistella et al. 2017) Strategy innovation capabilities are capabilities which are innovative and adaptive by constantly reacting to change and pro-actively reacting on limitations within the organisation. (Battistella et al. 2017) Resource capitalisation capabilities are the capabilities to create and develop resources and capitalise on them in order to create a competitive advantage. (Battistella et al. 2017) The third capability category is networking capabilities, which refer to the capabilities to create an interdependent relationship between two organisations and how to benefit from each-others resources. (Battistella et al. 2017) Therefore, as all the previously mentioned aspects can be divided over these categories, this framework will be used to analyse the internal resources.

2.4 External environment on the development of a business model

As mentioned before, in order to analyse the development of a sustainable business model, next to the internal factors, also the external factors should be analysed on their influence. An environmental analysis is crucial for developing a sustainable competitive advantage and identifying opportunities. (Kraja, Osmani, 2015) (Chahabachi, Lynch, 1999) Technologies and environments are constantly evolving. (M. van Limburg, 2016)(Al Dabei, Avison, 2015) In order to understand what is expected of a technology in a constantly evolving environment innovators should involve stakeholders. (Freeman, 1984) Their needs should determine the development of the technology as they understand what is critical and relevant value drivers are for a technology. (Yusof, et al. 2008) Thus, by constant input and evaluation of stakeholders e-health technologies can be improved. Therefore, a technology should reflect the stakeholders needs. Business modelling can contribute to this as business models consider stakeholders for the total development process. Business models are value driven and see stakeholders as the most important source for improvements in the development phase. Furthermore, a business model defines how a company is related to and interacting with its environment and all other participants in the value network. (Al Dabei, Avison, 2015) However, stakeholders needs can change over time, which could lead to business model erosion. (McGrath, 2010) Which means that because the needs of stakeholders may change over time, innovators could miss this shift of needs and fail to understand that e-health technology is not sustainable and

effective anymore. (van Limburg, 2016) Therefore, the stakeholders' needs and other aspect of an external analysis need to be evaluated continuously in order for the e-health technology to remain sustainable.

There are multiple tools to continuously analyse the external environment of an organization. (M. A. Schilling, 2017) Most commonly used are Porter's Five-Force model, a SWOT analysis and a PESTEL analysis. In order to describe the external factors of the business canvas, the tool should be able to identify the channels, customer segments and the customer relationships. Furthermore, this tool should be able to identify opportunities for the e-health industry and it should contain aspects in which it could be described what could influence the sustainability of a business model.

As Porter's Five-Force model is mainly focussing on evaluating the position of a business organisation towards its competitors, this tool is not suitable to identify customer segments and relationships. Another tool is the SWOT-analysis tool. This tool does recognize the opportunities and threats for organizations in the e-health industry. However, this tool is still not as specific as the PESTEL analysis. A PESTEL analysis is a structured way to analyse and describe external factors and how these factors influence the industry. (J. Song, Y. Sin, L. Jin, 2017) A PESTEL analysis, analyses the political, economic, social, technological, environmental and legal aspects of an organization.^{xii} Therefore, as the social aspect describes the customer relationship, the economic aspect describes the channels and segment, the political aspect defines the opportunities, and the environmental aspect could define the influences on sustainability, this analysis is the most suitable to describe the external factors of this business canvas.

3. METHODS

This thesis uses a descriptive research of a case study in which multiple company's business models are analysed and compared with the theory obtained in our preliminary research. In order to make this analysis, secondary data is used in combination with the use of interviews. Secondary data contains of reports found on the internet, scientific articles and reports by the company itself and the Dutch ministry of Public Health. These were found by University of Twente online library and Google Scholar. This was done by searching for specific business model development aspects

In order to analyse the external environment, a PESTEL analysis is used. A PESTEL analysis analyses the political, economic, social, technological, environmental and legal aspects of the organisation. As these are part of the external environment for a sector, these factors are all constant for the analysed organisations. The difference will be in how the start-ups have made use of these circumstances. See Table 1 for a clear overview which circumstances will be analysed.

Political & legal	Political opportunities; regarding government policies, government investments, and further goals of the government
Economic	Cost-effectiveness, opportunities for investments
Social	Social aspects of e-health, customer needs, side notes of e-health
Technological	Technological opportunities; regarding advanced technical infrastructure and technical dependency

Environmental	Aging population, increase chronic illnesses
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Table 1. PESTEL

In order to analyse the internal environment, the resource-based view is used in combination with the three categories of capabilities. (Battistella et al. 2017) The resource-based view will describe which resources are used in order to create a sustainable business model. As it is more difficult for a start-up to create such a business model entirely by themselves, the analysis will also focus on the stakeholders involved in the development process and what the start-ups relationship and degree of involvement was with them. The three main categories of capabilities to identify the internal capabilities are strategy innovation capabilities, resource capitalisation capabilities and networking capabilities. These aspects will be described in the case analyses. The difference will be in the choices the organisations have made in order to create a sustainable business model. See Table 2 for a clear overview what the three main categories contain of.

Strategy innovation capabilities	Adaptive capability, agility, innovation, managing threats
Resource capitalisation capabilities	Cultural capability, gain resources, technological competencies
Networking capabilities	Collaboration, integration capability

Table 2. Internal capabilities framework

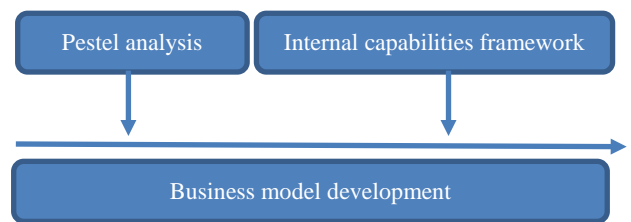


Figure 3. Visualization of framework

The purpose of this research is to describe how internal and external resources influence the development of a business model of a start-up in the e-health industry in the Netherlands. The framework used for this paper will be the Osterwalder & Pigneur's 2010 canvas, because of the detailed specification of every aspect. As problems in the e-health sector can be addressed by a better implementation strategy early in the development of eHealth technologies, it is a required characteristic that these start-ups already implemented their innovation in the market in order to be analyzed.

Gaining data for this research has been done via the use of interviews. The use of interviews was a choice because of the ability to compare the original idea with the current situation and ask about the choices and shortcomings during their business development process. Questions were asked considering their original idea for starting their start-up, the original need it should fulfil and the resources during this development. These were compared to the current situation to which extent their product is still fulfilling the same needs and if during their business development changes have taken place considering their implementation strategy. (See appendix.)

Of every start-up one person has been interviewed, a requirement was that this person had knowledge about the development of the organisation. The cases were chosen based on prestigious results

selected by an independent organization in the digital health sector. Therefore, the business models of JouwOmgeving, SkinVision and Umenz are analysed. All start-ups started six years ago, which makes the time available an independent factor for the influence on their business model development. *Umenz* is chosen as they have proven to be a successful health innovator by winning the health innovation prize in 2017. The founding partner of this organisation was interviewed for this analysis. *JouwOmgeving* JouwOmgeving is an e-health start-up which is in the top 20 most promising digital companies, chosen by the health tech summit. ^x One of the founding partners was interviewed for this analysis. *SkinVision* is chosen as it was the winner of the Dutch digital health challenge in 2017. ^{xi} The current CEO of this organisation was interviewed for this analysis.

4. ANALYSIS

4.1 External environment

4.1.1 Political and legal

The political aspect is about the extent to which the government intervenes in the economy. ^{xii} This can be done by the use of regulations and investments. Therefore this is in cohesion with the legal aspect of this analysis, as those are the regulations which have an impact on the business environment. ^{xiii} There are three key levers in the external environment that influence the degree of adoption of medical technology within a given country. (KPMG, 2017) These levers are regulatory enablement, incentives to make it happen, and necessity as the enabler of innovation. (KPMG, 2017) Thus one of these levers is the regulation or policy within a country. A government is able to influence the regulations and policies in order “to reduce barriers to access, affect speed to market and to promote adoption of technologies in care delivery.” (KPMG, 2017, p.48) This is confirmed by the founding partner of Umenz, who emphasized that the regulations of the government are not only a helping tool to avoid certain mistakes, but that the regulations could also serve as a certain threshold for competitors in order to compete with an organisation which already dealt with all the regulations. Therefore the government can be seen as a strategic partner during the business model development of a start-up. Furthermore, “health technology assessment (HTA) bodies have a certain degree of influence on advising or deciding about the reimbursement of new medical technology.” (KPMG, 2017, p.48) Which in turn leads to an increased adoption of the technology. (KPMG, 2017) These statements show that the government does have an impact on the adoption of medical technologies. Therefore, a current obstacle for the government is to support the use of medical technologies, while still emphasizing the importance to fulfil the patient’s needs. (KPMG, 2017)

The Dutch government realises that there are several advantages to the e-health industry and that they are in power to have an influence to the implementation process of it. (KPMG, 2017)(Health Holland, 2017) Therefore, the government is one of the co-investors for the health & life sciences sector. (Health Holland, 2017) Extra investments is also the second key lever in the external environment that influences the adoption of technology within a country. (KPMG, 2017) “The adoption of medical technology can be increased by flexibility in funding healthcare including a possible return-on-investment, and by explicit incentives to use medical technology.” (KPMG, 2017, p.50) Till 2020 the government invests 20 million euros in order to stimulate the e-health industry. (Dutch government, 2016) To take it a step further, the newly formed cabinet even promised to invest 40 million in the e-health industry for the coming years.

(Dutch government, 2018) These are positive foresights for the e-health industry in total, which will increase the financial resources for the implementation of e-health technologies to become sustainable. However, as the CEO of SkinVision mentioned, “20 million in investments or 40 million even, is still is not going to help the whole e-health industry. Take a look for example what they have to offer in America, America has already invested over 2 billion in this industry.” Furthermore, what Umenz added on this, is that “the government could invest this money with more argued guidance.” What Umenz and JouwOmgeving experienced was that the money invested in the e-health industry often went to the wrong start-ups which eventually were not sustainable enough without these investments.

The final lever which influences the degree of adoption of a medical technology within a specific country is the necessity as enabler of innovation. (KPMG, 2017) For e-health this could be disadvantageous. Self-care in the Netherlands seems to be less of importance in comparison to other countries as patients can be tested by professionals for relatively low costs. (KPMG, 2017) This was supported by the CEO of SkinVision, who called this phenomenon the inhibiting lead. As the Netherlands tend to have a low willingness to change the health industry as it is of good quality already. This makes the use of e-health less necessary in the Netherlands. This could cause a lower adoption of these technologies by the patients, therefore a well-defined value proposition is necessary.

Furthermore, the government has several other actions planned in order to achieve their self-set goals. (Dutch government, 2016) These goals are to stimulate the e-health industry and are to increase the access to medical data, to increase the usage percentage of independent medical measurements and to increase the online contact to the health consultant. (Dutch government, 2016) The actions in order to achieve their self-set goals, next to extra investments, are “to support care innovators via their online platform, to make digital information sharing easier, to share knowledge about e-health, to make e-health more known and to make medical information sharing more safe.” (Dutch government, 2016) The government understands that this is their task as they are a value driver of innovation and could operate as a matchmaker who could bring parties together. (Health Holland, 2017)

4.1.2 Economical

The economic aspect in the PESTEL analysis is about how the state of the economy influences the organizational performance. ^{xiii} One of the problems identified is that once a research funding for an e-health technology stops, there is not enough capital to sustainably continue the innovation. (van Limburg, 2016) This could be a logical reason for the trend that potential care innovators stop innovating new technologies due to an unsustainable business. Furthermore, the e-health industry in the Netherlands is currently underperforming in comparison towards other countries, especially considering their ICT-infrastructure. ^{vii,viii}

What is seen now is that there is a lack of cost-effectiveness in the implementations of technologies in the e-health industry. (van Limburg, 2016) A business model can show an organization for their technical innovation what is necessary in terms of costs and how to lower them. (Johnson, Christensen and Kagermann, 2008) (KPMG, 2017) The use of business modelling could therefore prevent the economical trend of innovators which stop innovating new technologies.

Next to the implementation of a business model, also already mentioned in the political aspect of the analysis, investments also by other parties than the government contribute to the e-health

sector in its whole. “If there is more flexibility in the use of these funds, it is also easier to get a return on investment from new technologies.” (KPMG, 2017, p.50) These investments are also able to positively influence the implementation part of the technology in order to become more sustainable. What is seen in the e-health industry is that there are enough investors willing to invest in a start-up which could make them more sustainable and more able to develop an organisation over the next couple of years. However, the start-ups want to remain in control of their own technology. And therefore they are not always willing to collaborate with all the investors. What these start-ups want is an partner who is willing to invest their money in the idea as it is developing right now, without interfering too much with their own ideas. This could cause obstacles for the business development as financial recourses are necessary for a sustainable and overall business model development.

Another obstacle for the e-health industry in the Netherlands, as mentioned by Umenz, is that 70% of the revenue generated by successful Dutch e-health start-ups is generated abroad. Umenz and JouwOmgeving described this phenomena as something typically Dutch. Where a lot of talking happens about e-health, but this results in too little changes. Other countries skip a part of this algorithm and immediately make use of these technologies. This is also because of the necessity in that country. Umenz added, “as the distances between patient and provider in many countries is often way bigger than in the Netherlands, the need for e-health is bigger and therefore the implementation is sooner implemented.”

4.1.3 Social and environment

Social factors are of particular interest as they have a direct effect on how marketers understand customers, in this situation patients, and what drives them.^{xii} In order to understand this it is also necessary to understand who your patients are, and how to reach them.

E-health is a concept all about delivering health care information towards patients. (Vance Wilson, Lankton, 2004) It is about improving the health care for the patients, about optimizing the channel to bring the health care towards them, and about creating a new relationship between the health professionals. (Eysenbach, 2001) These three social aspects are part of the 10 e’s in “e-health” which describes e-health not in a predefined description but in ten aspects which together best characterize what e-health is about. (Eysenbach, 2001)

The first patient focussed ‘e’ is for empowerment of consumers and patients. “By making the knowledge bases of medicine and personal electronic records accessible to consumers over the Internet, e-health opens new avenues for patient-centred medicine, and enables evidence-based patient choice.” (Eysenbach, 2001) The second patient focussed ‘e’ is for encouragement of a new relationship between the patient and the health professional. Because of e-health technology this relationship should work towards a state where decisions are made in a shared manner. (Eysenbach, 2001) The third patient focussed ‘e’ is enhancing quality. Even though this seems obvious as the goal of every health care innovation is to improve the health care, in this social analysis it is of major importance. As stated in chapter 2.3, innovators sometimes find out too late that there is little demand for their innovation. Therefore, innovators should focus on what drives patients and integrate them in the innovation process. (Eysenbach, 2001) This is confirmed by the statement that stakeholder should understand *why* they are developing e-health technologies. Which also means that an innovator needs to focus on the patients’ needs and not on the innovation itself. Business modelling is again of a major importance. As the “current form of business modelling is

based on stakeholders who determine the role that the technology needs to fulfill in practice by forming an infrastructure and also determine what makes or breaks effectiveness and sustainability.” (M. van Limburg, 2016, p.39) So business modeling shows how it is of importance that an innovator understands its patients and knows what the patient drives.

What patients drives is that they want to be more informed during their health care process and during the decision making process. (Irizarri, et al. 2018) E-health is a factor which contributes to communicating these processes. However, as e-health is not optimally yet, patients are not having control over their personal health records to the fullest extent. A higher involvement of patients would enable patients to make more decisions about themselves. Patients would not only cooperate with what the doctor tells them, but have enough knowledge to formulate a well-fitting solution for themselves. (Irizarri, et al. 2018)

What is seen now is that this patient-participation is influenced by several factors. Health professionals tend to stay in charge of the healing process as they are the specialists. Furthermore, the process of informing a patient where it is able to make certain decision requires time. And it also depend on the illness which the patient has to deal with. The extend of participation also depends on cultural and societal influences. (Longtin, et al. 2010) As some processes do not require patiently input form origins, patients do not tend to breach this cultural habit. Furthermore, if professionals hint on the preference to work independently patients tend to omit participation. Thus, patient participation, and therefore the customer relationship, is highly influenced by societal and cultural norms. (Longtin, et al. 2010)

There are also two social threats which arise by the replacement of these activities by e-health technologies. The purpose of e-health technologies is to make the health care more efficient. However, this should not be at the expense of human contact. Only technological contact could have a negative influence on the doctor-patient relationship and therefore the e-health should be focused on the needs of the patients and not on making use of the technology. (Dutch government, 2012) The second social side note of e-health technologies is that the patients should be capable enough to work with the e-health technologies. A patient should mentally and physically be able to work with the technologies, be motivated to work with it and be confident with it in order for the e-health technology to function. (Dutch government, 2012)

The last factor in which are social influences, are the multiple revenue-models. There are multiple channels on selling an innovation. These channels are direct to the patients (B2C), via the health provider (B2B) or via the health insurer (B2B). Every customer, B2C and B2B, has their own reasons why to make use of the innovations available. Because of the different types of customer segments, different opportunities arise. Although there are multiple opportunities to exploit, this also increases the complexity. What is seen is that start-ups lack the understanding who their customer segment really are, as all three customer segments are intertwined. This adds a social complexity to the e-health industry.

The environmental aspects considers all the factors which are influenced by the natural environment.^{xiii} There are two social factors which can be identified within this segment. The first factor is the aging population and the second factor is the increase in people with chronic illnesses.

The social environment has an influence on the business environment as the increase in demand for healthcare is caused by an aging population and the rise of obesity. (M. van Limburg, 2016) As the population is aging, new challenges will arise, as there will be an increase in chronic diseases. (Garza, 2016) Heart

deceases, asthma and especially diabetes will play more significant roles in the health care. (Shaw et al. 2010) This not only means that there will be an increasing demand for health care, but also an increasing number of patients whom this health care information needs to be delivered towards. This is where the use of e-health can make a difference. This is because e-health can provide the main platform where health care information can be shared. With a target segment which is aging, there is one 'threat' which need to be taken into account. The successfulness of e-health depends on the education level of the users. (Muzawir, Nguyen, Kaija, 2013) Although the younger generation has been raised with the use of technologies, elder people have not. Elderly lack the education in ICT and therefore struggle with the use of complex e-health technologies. (Muzawir, Nguyen, Kaija, 2013) Therefore, a coming challenge for the e-health industry is to educate the older potential users in order for the technologies to become more successful.

4.1.4 Technological

The technological aspect of the external analysis, analyses potential technological innovations which can influence the e-health industry favourably or unfavourably. ^x The technological infrastructure in the Netherlands is progressive, as it is one of the precursors in application of new technologies. ^{xiii} However, developing a good technology is not enough in the e-health sector. (M. van Limburg, 2016) As mentioned in chapter 2.2, a barrier for an e-health technology could be the technology *itself*. This is described as the 'field of dreams syndrome', where innovators assume that once a particular technology has been developed the customers will come with it. The innovator therefore only focusses on the technology. (M. van Limburg, 2016)

However, there are also two other technological factors to keep into account. Because of the increase in technological communications, patients become dependent on the technology. Not in a social perspective, but technically dependent. With electronics there is always the risk of technical failure. Problems could arise like frequency overlap and loss of connection. Which could cause obstacles during the health care process. (Dutch government, 2012) The other technological factor is that because of the technology the patients and the care taker are in a physical distance. If a technology is making incorrect assessments or its monitoring is malfunctioning the consequences could cause harm for the patient, as the professional care taker is not in physical presence to decide otherwise. (Dutch government, 2012) This is can be seen as an obstacle for the channels block in a business model development as this aspect should be considered.

4.2 Internal analysis

4.2.1 Strategy innovation capabilities

4.2.1.1 Umenz

Umenz has some difficulties in their strategy innovation capabilities. "We could- or maybe should have focussed earlier and try to go for the quick-win." Which means that they were focussing on a technology to become innovative, and lacked the capabilities to adapt on the opportunities available. However, the founding partner did quickly adapt on the opportunity to attract a health care professional with a technical background, which enabled them to develop their technology in-house. Despite this, the influence of a lack of adaptive capabilities on business model development is that their well-developed value proposition and key activities have taken too much time during the development process and were at the expense of other building blocks. Due to the focus on their innovation, Umenz is in a starting phase of their technology implementation.

4.2.1.2 JouwOmgeving

From a strategy innovation capabilities perspective, JouwOmgeving had some difficulties too with their focus. "If I could have made a change, I would have defined better what our focus was and what we do and do not want to offer in our technology." Which means they wanted to have a more proactive research in what to insert in their technology. What can be seen is that JouwOmgeving was adaptive to the changing environment. However, they lacked the agility to decide where to focus on, and let this focus depend on the incoming assignments. Furthermore, JouwOmgeving made good use of management support as they realized in an early phase of technology development how important the implementation process would be. "We were constantly evaluating what organisational change was necessary for the implementation, and we were searching for ways to make this implementation concrete." What can be seen is that their key activities were based on the need of clients at the start of their business model development, this caused their customer relationship and key activities to be well defined.

4.2.1.3 SkinVision

For strategy innovation capabilities SkinVision formalized their focus early in their development process. The core of the organisation is the technology, which function is making skin-assessments, and from this perspective they created a plan which segment to offer this product to and which markets to embed. Due to a specific focus, SkinVision was adaptive to- and innovative for the changes in different environments. Furthermore their strategy innovation capabilities were also well structured due to the appointment of a new CEO, who added his managerial experience mainly into the positioning of the brand. This caused their business model development to be balanced between a clear value proposition, the key activities and the customer relations in order to position the start-up.

4.2.2 Resource capitalization capabilities

4.2.2.1 Umenz

Umenz is also encountering problems in their resource capitalisation capabilities. This can be explained by the lack of financial resources as the opportunities for investors have not yet been taken. "We are searching for an investor which provides an ongoing credit." This means Umenz is searching for an angel investor, which is hard to find especially in such an unstable business. Furthermore, due to a lack of financial resources Umenz has a lack of human resources to tackle other aspects of their planning. What can be seen is that their focus during their planning was on their value proposition and key activities which caused their channels, customer segment and customer segment to lack the necessary resources to give meaning to. Furthermore Umenz is also lacking a clear marketing plan. As their founding partner stated: "Our focus on the technology development was necessary, however this was at the expense of our marketing." This can again be explained by a lack of planning and financial resources. Therefore, their cultural capability lacked a specific plan how to reach their goals. On the other hand, Umenz did have technological competencies necessary for their product. By making use of a 'networking' strategy, Umenz qualitatively outsources a lot of work because of their experience and partnerships created and transfers this knowledge in their product.

4.2.2.2 JouwOmgeving

JouwOmgeving also has a vision how to make use of their resource capitalisation capabilities. Their vision and planning is reasonably defined as they have a clear goal for 2025. However, in order to actually reach this goal they lack a concrete plan.

Their branding is better defined, as with their branding they are specifically focussing on how to qualitatively brand their technology, without a clear sales department as a strategic choice. Furthermore they make use of experience stories and social media. They also had their financing well figured out as till now JouwOmgeving has not needed any external investors yet, which means JouwOmgeving is performing well on gaining resources. JouwOmgeving is created from a collaboration of two organisations which they used both development budgets for in order to create JouwOmgeving. Although this could pose a future obstacle, they are now investigating which aspects they might do need investment for and how this can be structured. This means that their business model is rather well-developed, however that they are still in a middle phase of their technology implementation, hence lacking some concrete action plans.

4.2.2.3 *SkinVision*

In terms of resource capitalisation capabilities SkinVision focussed on the marketing (branding), which is now one of their best characteristics. Furthermore, SkinVision has a well organised planning because of a clear goal for the next decade and identified the opportunities how to reach this goal. As SkinVision already went through a first round of investments, their financial resources are on level. However, SkinVision is focussing on a second round in order to expand even more abroad. This means that due to a well-balanced business model development and by making good use of resource gaining, SkinVision is able to expand their customer segment.

4.2.3 *Networking capabilities*

4.2.3.1 *Umenz*

Although lacking a clear marketing plan, Umenz excelled at their networking capabilities. Umenz made good use of their collaboration capabilities, as they created a network which was able to supported Umenz to keep a clear function for their technology and therefore recognized the need their technology should fulfil. This helped Umenz with their value proposition development. Furthermore, the board of advice also questioned the presence of competitors. As Umenz claim that their technology is new and that competitors only focussed on one specific disease and therefore 'quick-wins', Umenz did consider their competitors, but does not feel threatened by them in the long-term. Integration capabilities are less defined as the product is only offered to the market for one year. Which is seen in their customer relations.

4.2.3.2 *JouwOmgeving*

Networking capabilities were necessary as the content of their module is determined by their partners. JouwOmgeving is only facilitating the process of guidance and the integration of all stakeholders involved, but they are not facilitating the actual content of the modules. What specifically can be seen is that they are a technical organisation which needed the help of health partners to create their partners to develop the content for in the technology. From the start of their technology implementation, JouwOmgeving chose to let their focus depend on incoming assignments. Which causes there to be a strong interdependent relationship with their partners. JouwOmgeving described this as a well-functioning process where the health providers needed their technology and JouwOmgeving their expertise and experience to fulfil a need. Furthermore, their integration capability is a quality as can be seen in the customer experiences.

4.2.3.3 *SkinVision*

The networking capabilities of SkinVision were less present because of an in-house technology and financing. Therefore, their integration capability was of more importance than their collaboration. In terms of collaborations, SkinVision made use

of strategic partners for the development in order to gain CE approval. One of their other key characteristics is their integration capability. As SkinVision's key activity is the guidance of a customer into a patient-professional relationship. This can be seen in their patient's testimonials.

5. CASES

6. UMENZ

Umenz is a start-up in the early phase of their technology implementation process in the e-health industry. For the last couple of years Umenz has mainly focussed on expanding the quality and quantity of their technology. "A next step for Umenz is to create a new marketing plan, we had too little time for this, which makes it one of our weaker characteristics." The problem Umenz identified is that the health industry is too complex. Umenz recognized that an health eco-system needed to be created which was patient-centred, where the patients could get in contact with all his health professionals and providers in one application. This research phase is where Umenz spend most of their time until this moment, which can be seen by the lack of implementation in the industry. This is due to the fact that the product is only offered to the market for only one year, as the innovators did not deem the technology thorough enough yet to offer it. Because of the time spend in value specification and contextual inquiry Umenz lacked the planning and resources for the design and operationalization and is thus not able to evaluate how the technology is used and what the effect is on the market. This can also be seen in their business model, where the channels and customer relations lack the information to give meaning to. On the other hand, the value specification, key activities and partners are well-defined. However, the specific focus on these building blocks is also the reason why Umenz is lacking a clear marketing strategy. Furthermore, Umenz fails to really benefit of the resources from the external environment except from the political aspect. Umenz does profit from the government regulations, as they pass the regulations from the government. "And if we pass the regulations of the government, the competitors should prove themselves that they are able to do that too." Furthermore, they see the government as a supporting organization which prevents them from making big mistakes. However, the other external aspects have had little influence on the development of Umenz' business model. Also due to the fact that Umenz has not made use of the investor opportunities available. From the internal capabilities perspective it can be stated that their broad focus and therefore lack of marketing is compensated with their key partners' expertise. As Umenz states: "we are only the facilitator of this process and the real content is provided by our quality partners." By making use of this 'networking' strategy, Umenz qualitatively outsources a lot of work because of their experience and partnerships created. Concluding, it can be stated that Umenz key partners were necessary in the development in their business model, however this development is still not as complete due to a lack of financial and planning resources. This has to do with the fact that the technology is in its starting phase of implementation and only recently does Umenz recognize the need for a marketing plan. In order to gain a better market position, these aspects are the primary aspects Umenz should focus on in the coming implementation phases.

7. JOUWOMGEVING

JouwOmgeving is in the middle phase of their technology implementation in the Netherlands. What JouwOmgeving realized is that the patient had a need for more transparency in the health care. "At this moment there is a big secret between the reports, and what is done with them." JouwOmgeving removes

this secret which has a positive effect on the guidance and treatment of patients. Furthermore, they realized that there is a lack of communication between the health professionals. “What is seen, is that health organisations do not know what other health organisations are doing with the same patient, this is a phenomena which can be prevented.” What JouwOmgeving tried to create is a systematically approach, which reduces the complexity of the mental health sector from a patient-focussed perspective. They made this idea concrete in the form of technology. This technology enables the transparency by showing the goals of the patients, the reports and the communication between professionals, all available in written transcript available for patients. The effect is a higher patient participation in his own health process and a more efficient health process. JouwOmgeving’s business model is well thought out, however with a lack of international partners. This could cause obstacles for JouwOmgeving to broaden their market segment, which is part of their goals. From the external analysis perspective, JouwOmgeving has not benefitted from the political aspects yet. However, they added a special function to their organisation to have a claim on the government investments. The economic aspects were less necessary because of a personal funds available. However, as 70 percent of the revenue is usually generated abroad, and JouwOmgeving is only operating in the Netherlands, they are missing an opportunity. Furthermore, JouwOmgeving is not really impacted by technological aspects because of an in-house technology department. The other external aspects had minor influence on the development of the business model of JouwOmgeving. From an internal capabilities perspective, what is seen is that their resource capitalisation capabilities are well defined during the business model development process. However, they still need to concretise their plans into real actions. Furthermore, what JouwOmgeving lacked was a clear goal for their technology as their focus depended on incoming assignments. This made their networking capabilities rather strong as their partners defined the needs of their technology, which made these organisations interdependent. Concluding, it can be stated that JouwOmgeving is in the middle of the implementation process. They have thought out the process they are in right now, however they still need to make a concrete plan to develop their business in the Netherlands and internationally.

8. SKINVISION

SkinVision is an advanced stage of their technology implementation in their chosen markets. They are currently involved in their second round of investments, which shows that this organisation has not only proven to be sustainable this far, but also that they are planning to improve their product and expand their market position. What SkinVision realized was that there is a lack of efficiency within the health sector, therefore they created a technology which is able to support and improve

the health professionals in their practices. The technology can function as a second opinion, causing less mistakes in professionals judgements. Furthermore, the technology can function as a threshold before contacting the health professionals. Both functions improve the efficiency in the health process by diminishing the patients which need to be assessed in a preliminary stage or in an advanced stage. The technology is offered within an application and is promoted via advertisements and health professionals. This technology is implemented B2C for the preliminary risk assessment and B2B as the supporting function, this causes the technology to improve the efficiency within the health care 20 times. What can be seen is that SkinVision has integrated all the aspects of a business model in their organisation, which means SkinVision covered all the aspects of *van Gemert-Pijnen’s* holistic framework. Their focus is mainly on customer relations and their technology, as these core concepts create their competitive advantage. It can be concluded that from the external factors of the PESTEL analysis, SkinVision benefitted the most from the economic and social aspects, where the other aspects had a minor influence or could be seen as a threshold to pass. The economic aspect is in correlation with the resource capitalization capability in terms of financing. SkinVision really benefitted from the investment opportunities available. SkinVision is already invested in by an investment fund, which increased the financial resources significantly to develop their application and to implement their technology in the industry, this made them less dependent on their networking capabilities. Furthermore, SkinVision is seizing the opportunities to offer their product abroad, where most of the revenue is generated. However, SkinVision is still not sustainable enough to finance their own growth, hence the second round of investments. The social aspect which SkinVision benefitted from has to do with that SkinVision understood the needs of their users. The users drive is to have a more efficient health process with the same level of professional interaction. SkinVision optimized this process without cutting the interaction with professionals, the only alteration was that the interaction was via technical means. This enabled professionals to give personalized advice when it suited both patient and professional. Via the technology, the customers were also more informed what process they would enter once they would become a patient, this increased the patient participation in their health and decision making process. Furthermore, SkinVision’s quality is in making use of their internal capabilities. Due to an early focus in their technology implementation process, SkinVision has benefitted from their resource capitalisation capabilities and developed a sustainable business model, without the dependency on external partners. Concluding, it can be stated that SkinVision is well on its way to become a sustainable organisation. Their clear focus created a stable basis to develop their organisation and the technology and vision together will cause it to grow even further.

9. COMPARATIVE ANALYSIS

Start-up/ Analysing factors	Umenz	JouwOmgeving	SkinVision
External aspects exploited/considered:			
Political aspects	Sees government as a supporting organisation to prevent them from mistakes.	Recognises the governmental opportunities for in the future.	Is almost not influenced by governmental opportunities.

Economical aspects	Searching for investors and in contact with opportunities abroad.	Made excellent use of the funds available in founding organisations. Lacks opportunities abroad.	Made excellent use of potential investors and potential markets.
Social aspects	Has a clear understanding of the needs of patients and tries to reduce the complexity of the health care to react on these needs.	Has a clear understanding of the needs of patients and tries to reduce the complexity of the health care to react on these needs.	Has a clear understanding of the needs of patients and reacts on changes in these needs.
Technological aspects	Has no technical issues apart from necessary software updates.	Has some technical issues, but not with any consequences for the users.	Has minor technical issues apart from necessary software updates.
Environmental aspects	Covered all environmental obstacles.	Tries to adjust to benefit from the environmental needs.	Covered all environmental obstacles.
Legal aspects	Sees regulations as opportunity and threshold for other organisations.	Sees regulations as opportunity and threshold for other organisations.	Passes all regulations in order to offer product in different countries.
Capabilities and resources used to develop business model:			
Strategy innovation capabilities	Broad focus in technology development, with investor board of advice as managerial support. Could/should have focussed earlier for 'quick-win'	Focus defined by incoming assignments, with a well management support system for early phase technology implementation.	Focus early in development process. Management recognized need for new CEO with more managerial approach.
Resource capitalisation capabilities	In search of angel-investor. Lack of clear marketing plan. Decent planning, with little resources yet to act on.	Not concrete, and vaguely defined planning. With thought out branding and in-house funding.	Benefitted from investor opportunities. Branding as main characteristic. Well formulated future planning.
Networking capabilities	Excellent partner relationship, with high necessity for interdependent collaboration.	Excellent partner relationship, with high necessity for interdependent collaboration.	Good partner relationship, with medium necessity for collaboration in order to develop internationally.

10. CROSS-CASES ANALYSIS

All three organisations are created six till seven years ago which means that the differences in implementation approach is independent on time available, but dependent on the use of external and internal resources. What can be seen is that all three organisations are in different phases of the holistic approach' foundation. Umenz, is in an early phase of implementation, which means they almost finished their value specification and contextual inquiry, and that they are in early phases of design and operationalization. JouwOmgeving is one step further, who noted the importance of the implementation earlier on and therefore they are already in an advanced stage of their design and operationalization phase, and therefore the effect of their technology is slightly identifiable. Last is SkinVision, a start-up which already is in an advanced stage of their summative evaluation and therefore knows the effect of their technology. As the effect of their technology is satisfying the customer needs, SkinVision is expanding to markets abroad. The difference between these phases can mainly be explained due to their strategy innovation capabilities. Where SkinVision focus is only on their core technology, in combination with an early recognition for the implementation process they created an advantage towards the other start-ups in terms of implementation in the market, market position and financing structures. This matches Cavalcante's statement, that business models could have a different focus during the business model development process,

causing different business models and different ways to act on them. Umenz and JouwOmgeving their product focus are broader, both trying to create a patient-based eco-system which made them dependent on a lot of research and qualitative partners and information. Due to this elaborate focus in their strategy innovation capabilities, their resource capitalisation capabilities suffered. Where JouwOmgeving has described a clear goal, they lack a concrete plan how to put these plans into actions. Umenz has only offered their product to the market for one year, and is now realizing that their broad focus went to the expense of a marketing strategy. These phenomena match E. Herzlinger's description, where innovators tend to focus too much on the innovation *itself*, and fail to investigate the need for their technology or the existence of competing ideas. Due to this broad focus, Umenz and JouwOmgeving were also more dependent on their networking capabilities. For Umenz this was specifically beneficial, as their network did not only provide financial resources, but also tried to guide Umenz towards a technology which solved a need in the health care. Therefore it can be stated that their excellent networking capabilities partly compensated their lacking strategy innovation capabilities and resource capitalization capabilities. For JouwOmgeving this was less of importance as they were already in possession of the development funds necessary and they realized the importance of the implementation process early on. Still their networking capabilities were of essence for their development of their

technology as they only provided the technological processes and not the content. The difference because of SkinVision's specific focus can be seen in their resource capitalisation capabilities and dependency on the external environment. As they only needed to focus on one core technology, their resource capitalization capabilities could focus on the need for marketing, a well defined planning and a long-term financing plan. Furthermore they were less dependent on networking capabilities, apart from the clinical trials necessary for CE approval. As SkinVision is in an advanced stage of technology implementation, they are also more able to make use of external opportunities. They are less dependent on government decisions regarding investments and were due to a well-argued goal in an early stage applicable for external investments. Furthermore, because of this advanced stage of implementation SkinVision was able to offer their product abroad, which is a major economic opportunity. JouwOmgeving and Umenz both acknowledged the opportunity for governmental investments, however the difference is that JouwOmgeving has more financial resources available to act on these opportunities. JouwOmgeving recognized the opportunities and therefore created a new function only focussed on making claim on the governmental investments. On the other hand, Umenz lacks the resource capitalisation capabilities to tackle this and therefore is more passively hoping to make claim for these investments. The problem identified for Umenz is that they are searching for an angel investor. This could cause some obstacles as angel investors often invest in seed or early stage companies, however the angel-investor market is characterized by a well-defined due diligence. (Ding et al. 2014) This is something Umenz lacks. Differences in the social, technological and environmental aspects were harder to identify. Although e-health is all about the technological aspects, all organisations stated to have minor technical issues. The only difference could be seen in terms of costs. Umenz described the technology to be 80% of their costs, this comes due to the fact that they are health care professionals providing a platform. The other organisations mostly had their technology in-house, being an IT-firm working in the health care industry. Which, could be the reason for difference in expenses.

11. CONCLUSION

Internal and external factors influence the development of a sustainable business model for a start-up in the e-health industry both in different degrees. It can be concluded that the external aspects are less of influence on the development of a sustainable model than the internal aspects, but are more thresholds and governmental guidings to consider in order to be able to create a sustainable business model. Once a start-up is in a more advanced stage of their technology implementation (e.g. operationalization or summative evaluation), these external aspects are able to create opportunities in terms of economic and political aspects. The internal capabilities are more of influence on the development of a sustainable business model. The strategy innovation capabilities determine to which extent the organisations are innovative and able to adapt to the market. What can be seen is that a broad focus causes a start-up to be less adaptable to the market and it takes longer to develop an entire business model. The resource capitalisation capabilities are focussed on the planning, marketing and financing of the start-up. A broad focus for a technology causes a lot of research. However, this research should not be at the expense of marketing and promotion activities. A well thought out planning is therefore necessary to integrate both the development and marketing of technologies into one start-up. The financial resources are than necessary to act on this planning. This planning will than determine what is needed for the technology implementation in the current phase of a start-up. The networking capabilities could

function as a supporting capability to compensate for the other less defined capabilities. However, the further a start-up is in their technology implementation process, the less dependent the start-up will be on their interconnectivity. Therefore, what can be concluded is that the more developed a business model is, the more a start-up is able to act on this business model and implement their technology in the industry. Once a business model is fully developed and their product is well-implemented in the health care industry, a start-up is able to offer their product abroad as this is a significant economic opportunity. These conclusions are in agreement with van Limburg's findings, considering the positive influence of a fully developed business model on the technology implementation process in the e-health industry.

12. RECOMMENDATIONS

A recommendation for the start-ups in the early implementation phases would be not to focus only on your key-resources and key-partners but also try to understand how other start-ups managed their technology implementations. This could cause them to realize the importance of the implementation process much sooner, which will eventually lead to a more sustainable adoption of technologies in the e-health industry.

13. LIMITATIONS AND FUTURE RESEARCH

There are a few limitations and opportunities to this thesis. As mentioned by van Limburg, there is not only a need for more research on business models in the e-health industry, there should also be more research on how to create these business models. Furthermore, what could be researched in the future is if a broad focus is an advantage in the long-term. A multiple timeframe research should therefore be performed. Limitations of this paper are that the conclusions made are only based on three start-ups, and the secondary data of other papers. Which is a small sample to draw conclusions on. This was due to time constraints as more time could have enabled the ability to research even more start-ups. A second limitation is the subjectivity of the interviewees. Although they all answered as honestly as possible, the answers given were interpretations on how they estimated the performance and development of the start-ups rather than an objective analysis. Which could cause biases in the comparison between these start-ups.

14. APPENDIX

Business model canvas Umenz

Key partners	Key activities	Value proposition	Customer relations	Customer segment
<p><i>Investors:</i> Board of expert advice while providing some funds at the same time.</p> <p><i>KNMP, Health Base, NHG:</i> Reputing knowledge sources for the supporting information within the application. Together they work towards a better foundation for the future medical industry.</p> <p><i>Blausen Medical:</i> Creator of the medical animations.</p> <p><i>Studio Black:</i> An online creative agency, which has a history in the healthcare regarding patient focussed projects.</p> <p><i>Pronamic</i> A known player in specialized WordPress solutions.</p>	<p>Umenz' facilitates patients' self-management with an innovative application which links the patients together with the health care providers. The key activity is to inform, support, guide the patient during their health care process. In addition, this application enables health care professionals to give more efficient and focussed advice towards patients.</p>	<p>The quality of Umenz is mainly differentiated in their technology, their qualitative partners and the effectiveness and flexibility of collecting and processing the information necessary for their technology. Furthermore, a competitive advantage is that both partners are experts in the health care, which makes them think from a health care perspective instead from a technical perspective while providing an application. Umenz is networking organisation which provides a complete ecosystem which can be connected to the patient. This provides that the focus is broader and therefore more specific than their competitors. This enables them to give the patient a more efficient, personalized and focused advice by professionals.</p>	<p>The product is relatively new to the market as it is actually only available for one year. Therefore not such a relationship has been build this far.</p>	<p>The customer segment of Umenz is focussing on the patients, B2C, and towards the health care providers, B2B.</p> <p>Patients could download the application to connect the patient with all its providers. Providers could procure a Umenz website-template for medical information to support the digital health aspect, to make appointments, to issue recipes, and for an easier control of their website. "Both segments are mainly focussed on the Netherlands, but we are in contact with Belgium, Portugal, Russian, Austrian, Indian and Mid-East parties. Which shows that our technology is well scalable.</p>
	<p>Key resources</p> <p>The most important resources for their application is the reliable supporting information technology about the diseases, the professionals and the health care providers supporting this application and the two employees with broad experience and expertise in the healthcare.</p>		<p>Channels</p> <p>The main channel is mouth-to-mouth, and health care magazines.</p>	
<p>Cost structure</p> <p>Website and application creation and development. Office rent. Employee salaries.</p>			<p>Revenue streams</p> <p>Revenue health providers (B2B) The product should be free for the patients.</p>	

Business model canvas JouwOmgeving

Key partners	Key activities	Value proposition	Customer relations	Customer segment
<p><i>Founding design and technical solutions organisations</i></p> <p>The foundation of the organisation for financial resources and expertise in the technology.</p> <p><i>E-KJP</i></p> <p>Development partner for interactive evidence-based processing protocols.</p> <p><i>Three major health providers.</i></p> <p>Providing a sustainable development to improve the technology and content of the technology.</p>	<p>JouwOmgeving is a secured online environment which enables integrated health. It can function as access gate, as a spill for client communication, as virtual treatment centre and as a system for online work processes. Which enables them to make the health care more transparent.</p>	<p>JouwOmgeving's quality is in the content, creation and technique, and to combine these elements to a stronger whole. Their software is focussed on the client instead on the professional. So a they are offering a real client perspective, which separates them from their competitors. Furthermore, one of their competitive advantages is the transparency they are able to create with their technology, and their ECD screens are more friendly to use and less complex. Furthermore, they have an expertise network for youth psychiatry which provides them to offer personalized care on mental health, which is unique. What their founding partner also mentioned as a quality is the openness their organisation is operating with.</p>	<p>There is a solid connection between the clients and JouwOmgeving based on the experiences shared by users. They are often in contact with their clients for experiences and consultations how to improve their technology.</p>	<p>The customer segment is for patients (B2C), and for health providers in any size (B2B). It is mainly for clients with mental health problems focussed on the Netherlands. Although JouwOmgeving is aiming for an international market, the plan of action for this still needs to be developed. Therefore, the product is only offered in the Netherlands.</p>
	<p>Key resources</p> <p>The unelaborate technology providing an entire ecosystem for the clients to increase patient participation. The financial resources available from the founding organisations. The developing partners necessary for the development of the technology.</p>		<p>Channels</p> <p>They are investing on their market department, which main task is to be present at events and go by health providers. Their focus is on quality content and not by means of a sales pitch. Furthermore they make use of social media and sharing of experiences of previous clients.</p>	
<p>Cost structure</p> <p>Technical developers costs. Office rent.</p>			<p>Revenue streams</p> <p>Revenue health providers (B2B) Planning to gain revenue from clients (B2C)</p>	

Business model canvas SkinVision

<p>Key partners</p> <p><i>Leo Pharma:</i> Ability to reach dermatologist worldwide.</p> <p><i>La Roche Posey:</i> Skin checker campaign collaborator.</p> <p><i>Maximilianhof:</i> Co-operator for clinical trials to gain CE approval.</p> <p><i>IBM:</i> Collaborator in identifying health start-ups with high opportunities in development.</p>	<p>Key activities</p> <p>The key activity is early detection of skin cancer by providing accessible dermatological services and accurate diagnosis through the use of their application. This application focusses on the guidance during this process, and not on performing the actual treatment.</p>	<p>Value proposition</p> <p>SkinVision’s quality is in their technology, branding and in the contact with their patients. Their technology is a technology which is not available anywhere else. They focussed specifically on branding in order to make the correct strategic decisions how to integrate this technology in the industry. And with the communication towards the patients, SkinVision is able to create a high degree of empathic abilities, which is necessary for the process where a customer becomes patient.</p>	<p>Customer relations</p> <p>With the high degree of empathic abilities, SkinVision is able to create a strong patient-relationship between the dermatologist and patient. SkinVision is also in contact with the patient themselves, which only contributes to the patient relationship.</p>	<p>Customer segment</p> <p>SkinVision is focussing on two segments. B2C with a number of 20.865 paying users, freemium based. And B2B with a total number of 74.880 reimbursed insurance customers. Both B2C and B2B are mostly divided over 4 countries: the Netherlands, UK, Australia and New Zealand with high recognition given the investments done in these countries. SkinVision is also in progress for FDA approval which should add the market segment of the United States of America.</p>
<p>Cost structure (cost or value driven?)</p> <p>Variable costs individual sales</p> <p>Relatively fixed costs health providers</p>		<p>Revenue streams</p> <p>Revenue individual sales (B2C)</p> <p>Revenue health providers (B2B)</p>		

Interview questions transcript

- How is this organisation created?
- What was the idea to start the company?
- What processes have you gone through to start this business?
- What were the biggest obstacles during the start-up of the company?
- What could have done better during the development of your organization?
- What has changed within the organisation since is started?
- Where did these changes occur?
- If you could have gone through the same process again, what would you have done differently?
- Which major strategic decisions have you encountered in the development process?
- What are the future goals for the company?
- What is the greatest quality of the company?
- How much help did you gain from partners to start up the company?
- How did you benefit from this?
- Do you still receive help from the same parties or has this changed?
- How did they benefit from you?
- How much did they contribute to your development process?
- How did your product become like this?
- How did this change in the meantime?
- What is the product doing now?
- What does the product focus on?
- What problem do you tackle with your product?
- What distinguishes this product from other similar products?
- Are you constantly evaluating your product?
- What do you want to improve on the product?
- For whom is the product originally intended?
- Are these also the people who now use it?
- Do you want to expand this target group?
- What do these people need this product for?
- How do you stimulate the use among your users and the other healthcare sectors?
- Do you also come into direct contact with your users?
- How do you reach these people?
- Has this changed compared to the beginning?
- How do you respond to the older generation?
- How much influence has the government had on the development of your product?
- Does the government still have the same influence on your organization?
- Was it difficult to find the investments to get your idea off the ground?
- To what extent do you now need new investments?
- How did your users contribute to the development of the product?
- Where do you make a profit? And how has this changed over time?
- Are there any specific costs for the application?
- Do you do a lot of marketing and promotion?
- What do you do to prevent technical problems?

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