Early Stages of Business Modeling for Open Source Home Care Technology

Lessons learned from an initial inventory

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Abstract— **Many eHealth innovations never get beyond the project phase. Initiating a viable business model in an early stage of the development of eHealth innovations enhances the chance of structural embedding the innovations in routine health care. This paper presents the early stages of business model development for an innovative IT supported home care system based on open source software. After a literary review on open source business models and the home care market, the eHix method, a business model approach developed by research group ICT Innovation in Health Care to is used build up the business model for the home care system. The structure of the eHix, a method in which one is only allowed to move to the next phase if the previous phase is completed, ensures an efficient and effective route to business modeling. Going through the first stage of the business modeling, it is clear that the mapping of intended target groups and their accompanying needs in various scenarios becomes key to determining the right value proposition for the intended home care system. In-depth analysis of all the stakeholders and their interest in the network then provides the essential criteria for the feasibility of the various scenarios. It is only after all the scenarios of the care system are mapped that the revenue models can be identified efficiently and further selective steps can be taken towards feasible business models that show the potential of the innovation to its full advantage.**

Keywords- Home care technology; Open source software; Business modeling.

I. INTRODUCTION

This paper provides an extension of the work presented at the eTELEMED 2014: The Sixth International Conference on eHealth, Telemedicine, and Social Medicine [1]. The work centers on the Hightech@home project, a project aimed at developing technology and knowledge concerning open source IT supported home care.

Home care is this paper is defined as the whole of care, nursing, treatment and support of the person seeking help at home, performed with the aid of self-care, informal care, volunteering and/or (additional) professional care and specifically designed to enable the person seeking help to live independently in his or her own home [2].

With the use of open source software the project is geared towards increasing availability of IT supported home care and lowering costs of IT supported home care by avoiding vendor lock-ins. The project team aims to enhance the chance of structural embedding of the IT innovation in routine home care; the end of the project should not imply the end of the innovation. Therefore the project also includes a viable business model for the Hightech@home care innovation.

This paper focuses on an analysis of the business modeling in the early stages of the Hightech@home care technology development, reflects on the initial findings and posits further challenges to the business modeling of open source home care technology. The paper aspires to contribute to the body of knowledge regarding the early stages of business modeling for home care technology and to clarify the fundaments of viable business models for home care innovations in order to increase the likelihood of practical embedding of these innovations in routine home care.

A. The Hightech@home project

The Hightech@home project consists of five tracks. The first track, the technical design and development, focuses on a portal being generically available through any web browser. The portal will facilitate video contact and transmit and receive data from sensors located in the house, on a portable device or on the body of the user. Technical design and development is iteratively informed by the user research in the second track. The iterative cycles start with small-scale experiments with mock-ups leading to a field study when robust prototypes are available. During this field study data will also be retrieved to perform a cost-benefit analysis, which is the third track of the project. To ensure the structural embedding, viable business models are developed in the fourth track. Finally, the fifth track aims to facilitate Bachelor students in the Hightech@home project in particular and in eHealth research in general through the development of a digital learning environment.

B. The choice for open source software

The Hightech@home project's choice for open source software is based on the current lack of low-cost, high-quality, high-tech, plug-and-play home care technology. Open source software is defined in this project as software of which the source code is available at no cost, the user is free to customize this code and integrate it into other systems

and products [3]. Open source software has the potential to enable system interoperability, which literally unlocks the consumer technology we already have in our homes and carry around.

If high-tech sensor and communication technology is available for home care, the costs are high. Potential users with the greatest need for this type of technology, e.g., elderly, chronically ill, often lack the required financial means. Vendor lock-in (mostly through the use of closed protocols) is one of the reasons for the high pricing. Customers are dependent on one vendor after an initial choice for home care technology. If there is, for instance, a wish for extending the current technology with additional sensors, customers appear to be dependent on the original vendor. Hence low-cost alternatives are not an option. Although completing a single project like the Hightech@home project will not break through an established vendor lock-in, the aim is to produce open source technology and knowledge, thus providing a starting point towards interoperability.

Existing home care technology often requires a technician for its installation. This not only results in extra costs, but also raises the threshold for people to start using it. By designing and developing plug-and-play technology by means of a co-creation process with potential end-users, the Hightech@home project ensures that customers (clients or patients), informal carers and care professionals are able to install the equipment. Furthermore, having interoperability at the center of development, allows for (re-)use of already existing technology.

By designing and developing an innovative home care application, the Hightech@home project aims to provide a starting point towards low-cost, high-quality, high-tech, plug-and-play home care technology. Being aware of the budding opportunities of this innovation, the project also strives to contribute to the structural embedding of this innovation in routine home care. The end of an innovative project like this should not imply the end of the innovation, which is often still the case with innovative eHealth applications [4]. In the reality of health and home care there is still a gap to be bridged between the opportunities offered by innovative applications in health and home care and the actual practice of routine health and home care. Although suggestions are constantly being made for the integration of innovations in health care, a comprehensive approach which supports the adoption of innovations into routine health care practice is still lacking [5].

C. Business modeling the project

IT-related business model innovations have been identified as a mayor factor in achieving structural innovation in health care [6]. Initiating a viable business model in an early stage of the development of the innovation enhances the chance of structural embedding the innovation in routine health care. Characterizations and definitions of business models are abundantly present in literature. Since the concept of service is a focus in the Hightech@home project and a number of partners – a

foundation, several small and medium enterprises (SMEs), a professional care organization and a University of Professional Education - will work together to create and deliver the service, we apply the definition of Bouman et all. (2008) to characterize the business model envisioned for this project: 'A business model is a blueprint for a service to be delivered, describing the service definition and the intended value for the target group, the sources of revenue, and providing an architecture for the service delivery, including a description of the resources required, and the organizational and financial arrangements between the involved business actors, including a description of their roles and the division of costs and revenues over the business actors [7].'

In earlier projects [5] the research group IT (Information Technology) Innovations in Health Care at Windesheim University of Applied Sciences developed a business model approach to be used as an instrument to bridge the gap of innovative eHealth ideas to successful IT-based care services. A key component of this approach is an online webtool: the eHealth Innovation Matrix [8]. Therefore theHix method is used during the Hightech@home project. The use of this method implies the application of relevant instruments and knowledge as included in all five phases distinguished in the eHix model
– this will be explained at section II Methodology.

Hightech@home's aim to achieve a better chance of structural embedding the innovation poses the question of a feasible business model. Hence this paper sets out to address the following research questions:

What business model would be most feasible for the Hightech@home open source technology innovation ?
- What are the specifics of open source and business models for open source software?
- What characterizes the home care technology market, and specifically in the Netherlands?
- What are the particulars to be considered in the early stages of business model development for open source home care technology?

This introduction has provided a summary of the aim of the Hightech@home project and its focus on open source and business modeling open source technology. Section II gives an overview of literature on the area of open source, business modeling and home care technology in the Netherlands. This is followed by the overview of the methodology used to build a business model. The methodology is then applied to the early stages of the development of the home care technology. The preliminary outcomes regarding the business models are being discussed and the paper closes with a conclusion and the identification of further work.

II.   OPEN SOURCE SOFTWARE AND BUSINESS MODELING IN HOME CARE

A.   *Open Source Software and Business Modeling*

1) Open Source Software

The use of open source software is central to the Hightech@home project. In order to determine the implications of the use of open source software for the business model design of the home care innovation, it is important to have insight into the potential advantages and disadvantages of the use of open source software. The first advantages obviously are the low costs of purchase and flexible customizing; the source code of open source software is available at no cost and the user is free to customize and integrate the code into other systems and products.

A fast time-to-market is mentioned in literature as an advantage of open source software in that adjustments and improvements by the community are quickly picked up and shared [9]. Another advantage is the fact that there are many tools and components available in the communities. Open source software can also increase the flexibility in integration projects with other tools and solutions, since one does not have to deal with intellectual property [10]. This benefit reduces the possibility of vendor lock-in.

In addition to the low purchase costs, the flexibility, the ability to customize and a fast time-to-market, Krishnamurty (2005) mentions the advantage of the support of a community of developers and testers. According to Krishnamurty, this will increase the robustness and reliability [11]. An interesting observation from West (2007) is that organizations usually invest heavily in the protection of intellectual property, often leading to the redevelopment of existing solutions. The open source model with its unprotected adaptability implies an evolutionary development rather than redevelopment. This implies that initial innovation budgets can be used more efficiently in open source projects. In addition to the above benefits West (2007) also notes less marketing spending as open source technology generally "sells" through word of mouth.

There are a significant number of disadvantages of the use of open source software mentioned in literature. Martin (2013) gives an excellent up-to-date overview of these disadvantages – starting with the degree of uncertainty regarding the support of the open source software [10]. Dependence on the strength of the community of developers and testers is a risk. While standard license structure with traditional software gives the guarantee of the supplier, the availability and continuity of the community is not always adequately secured, causing a serious liability that has to be taken into account. Also new developments and improvements on the open source software do not have to be in line with the users' IT strategy. Besides, the more the open source products are being customized, the less one can make use of standard training. This means that the user should allow more resources for these aspects. Other disadvantages regarding the use of open source software include the control of version and usability. Versioning can be quite complex, since there are many different developers making adjustments and improvements. This can also make usability problematic, as it depends on the developers in the community and the available resources.

2) Business models for Open Source software

Considering the specifics of the open source software, its advantages and disadvantages, it is clear that these specifics pose a challenge in developing a viable business model. Revenue models for open source software in literature make the fundamental distinction between commercial open source and community open source [12]. Community open source is open source software that is owned by a community or a legal entity representing the community. The community members typically do not derive direct revenues from the software but subsidize it from complementary products and services. In contrast, commercial open source is open source software that is owned by a single legal entity with the purpose of deriving income from the software. The open source software used in the Hightech@home project is community open source software. The source code of the project is available under only one license, the GNU General Public License Version 2 or later [13], and anyone can enter the market and generate revenue from the project.

There is often still the notion that utilizing open source software development does not offer any chances for revenues from products and thus there cannot be any successful open source business models [14]. However, already two decades ago open source successes showed that fruitful business models can be built around open source projects and products [3]. There are various ways of generating revenue from community open source software to be found in literature – for a good overview see Korhonen (2013). Overall the open source business models seem to center on the sale of complementary products and service to complete a whole product solution. The three dominant ways to collect revenue from community open source software are usually consulting and support services around the software, derivative products built on the community open source software, and increased revenue in supplementary layers of the software stack [15].

Besides selling complementary products and/or services, companies also have ways of capturing value and indirect revenues from the open source software by creating and guiding the formal architecture of the open source software. Particularly for platform technologies, control of the interfaces regulates the supply of complementary assets [16]. Therefore, a company that waives ownership of the software code creates a shared platform that fits best its own internal architecture and suite of complementary products. Similarly, ongoing leadership of open source community software allows a company's developers to influence the code to be most compatible with a firm's own requirements and software architecture, even in independent projects [9]. Even without influence, companies that are actively involved in the open source development may gain technical knowledge, which is suitable for deployment and support or

an expert reputation, which is useful in marketing.

While the models of revenue are developed with the open access of the software code as a focal point, over the years hybrid open source business models have been developed [17]. A hybrid model fuses open source licensing with commercial licensing of software. For example, customers want to extend a product they have acquired and this product comes with an open source license. The customers must then release the modifications they made under the same open source license. If customers do not want to do that, they can purchase a commercial license. The company using the hybrid model manages the licenses and competes against proprietary vendors. This business model requires the company to control very tightly the source code of the product. This might lead to a situation where open source developers and communities do not contribute much at all, defying the purpose and perceived benefits of open source community software.

Besides generating revenue, it is clear that the company has to address the challenges of working with open source in order to develop a successful open source business model. These challenges are mostly caused by the numerous actors in the open source software development [14]. The business model must be flexible enough when it comes to release dates and requirements implemented per release [18]. For a solid integration of open source business models into the company, the requirements of interacting with the open source development communities also need to be acknowledged and practiced by the company [19]. Developing the open source business model, the company's own needs also have to be taken into account. As Munga et al. (2009) remark, companies cannot use traditional business models as such with open source, but can adapt these models by making open source a fundamental part of them, while asking themselves what the future implications of this open source business model are.

The use of community open source software like the software in the Hightech@home project has considerable implications for the business model. The various models in literature do suggest creative solutions. Services and derivative products around the software, shared platform creation and hybrid models fusing open source benefits with commercial interests are all possible features to be taken into account while developing a sustainable business model. Because of the numerous actors in the open source software development, flexibility in the business model seems to be a key component for success.

B. Home Care Technology and the market in The Netherlands

In addition to the specifics of open source software, we also need to take the distinctive market into account while developing the business model for the Hightech@home project. So what is distinctive about the health and home care market, and specifically the Dutch market?

Dutch health care is accessible for everybody – this makes it unique [20]. Internationally there are only a few countries in the word where this is the case – only 5 % of the

world population lives in a country where good care is accessible to everybody. Worldwide the health care system has been put under strain for the last decade. The increasing life expectation, improved survival of people with acute and long-term conditions and a greater array of available treatment options are placing an increasing burden on healthcare systems internationally. The most vulnerable groups in society such as the elderly, the chronically ill and people with disabilities are encouraged to live at home longer than before. In addition, the economic crisis that emerged in 2008 still stunts the economic growth, which used to compensate and finance the increasing costs of health care. Even with substantial developments in IT applied in healthcare over recent decades, the perceived increase in productivity does not seem to compensate the increased expenditure yet [20].

Regarding the Dutch home care market specifically, there is a large range of technological possibilities available [21]. The home care technology varies from disclosure of information in text and images, video communication, screen case, telemonitoring to other IT applications like ambient technology which enables monitoring in and around the home. Many projects haven been initiated. The drivers for these projects are mostly rising expectations of patients, increased efficiency, increased life expectancy and demand of care, treatment and prevention, improved availability of technology and safety and quality demand [22]. Nevertheless, there is not much evidence of structural scaling and implementation of these projects. Many obstacles are encountered here. For instance, there are many initiatives for which the health costs are not compensated or investments are too high or there is a lack of other means for structural financing. Care professionals often do not comprehend the added value or have clinical concerns against the implementation of home care technology. Failing change management seems to focus too much on technological implementation. Doubts have arisen about safety and privacy, and lack of clinical involvement and lack of scientific foundation are other barriers that hamper structural scaling [22]. Also the economic crisis contributes to short-term politics and leaves little room for investment in the necessary cultural and organizational change. In addition every Dutch health and home care facility seems to have its own in-house innovative technology to distinguish themselves in the health market, thereby increasing the costs and not realizing the potential economies of scale. Overall the Dutch home care technology market can be characterized as an unstructured and unorganized market with many parties providing part of the solution [21].

With this in mind, we take a closer look at the landscape of home care technology in the Netherlands. Fig. 1 illustrates the Dutch health care scene with its many parties. While the Dutch government regulates the financing of the health care system, the health insurance companies and the municipalities purchase the care for the clients through the professional care organizations within these constrains. The clients receive their care from these selected care organizations and in return pay their premium to their health insurance company and tax to their municipality. Besides

professional care, many clients also rely on informal care; there are about 3.5 million informal carers in the Netherlands on a population of 16 million people [23].
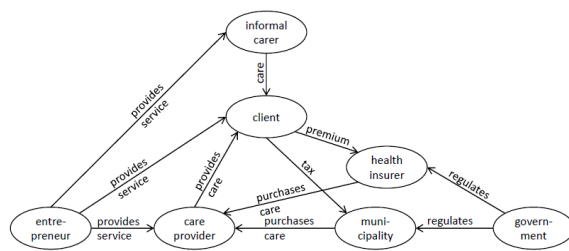

Figure 1. The Dutch health care landscape with its many parties

Since the beginning of 2014 a significant transition has been taken place, as a result of which a substantial part of the arrangements for home care will be implemented by the municipalities, who will take on this role for the very first time. The municipalities have considerable flexibility in determining what home care facilities and arrangements they deem necessary to organize or fund. It is expected that the municipalities will focus on cooperation with local parties (healthcare providers, day care facilities, community centers, social housing corporations, etc.). There is a lot of room for interpretation in the current framework contracts of the municipalities for their health and home care purchasing. It is not yet clear how the funding will be worked out by the municipalities, but heavy budget cuts are expected on all fronts [24].

Besides the technological developments and complex finance structure of the Dutch home care market, there is another important factor that defines the home care market: the dual client demand. Dohmen (2012) mentions the dual client-demand of home care technology - purchased by care organization but marketed to the end-user, the care consumer - as one of the most pressing aspects that makes the development and implementation of home care technology difficult [21]. Both parties can have different – often conflicting – requirements and demands. For instance, a care organization might be looking for a more efficient manner of care-giving, while its clients are happy enough with partial support. In addition to this, there is a gap between usage and expectation. The younger generation of care-professionals is often more used to working with technology than their older clients while the reverse can also be seen: a large part of the care-professionals is not trained in the use of information technology, while their younger clients are quick to master the technology.

With this context in mind, we see that the entrepreneur who is looking to market a home care innovation is dealing with multiple stakeholders in a turbulent landscape. The routes to the potential market are numerous and complex and entail different approaches in design, development and marketing of the innovation. To come to a viable business model in the home care market the method used to develop the model obviously has to incorporate these aspects.

It is clear from literature overview that the characteristics of the home care technology market in the Netherlands and the specifics of open source and business models for open source software pose challenges to the development of a business model for an open source home care system. The home care market is divers and complex and the use of open sources software asks for flexibility in the business model. On the way to develop feasible business models for the Hightech@home care system the particulars of the early stages of business model development for open source home care technology will come to the fore in the first methodological steps.

III.   METHODOLOGY

In order to develop a feasible business model for the Hightech@home open source project in a structured manner and to bring about the specifics of the early stages of business modeling, the eHix framework is used. As mentioned in the introduction of this paper, in earlier projects the research group IT (Information Technology) Innovations in Health Care at Windesheim University of Applied Sciences developed a business model approach as an instrument to bridge the gap of innovative eHealth ideas to successful IT-based care services. This approach, the eHealth Innovation matrix (eHix), is well-suited to the characteristics of an IT service innovation like the Hightech@home home care services [25].

The starting point of the eHix method is the STOF model (Bouwman, De Vos & Haaker, 2008) [25]. This model provides a systematic approach for service and business modeling of innovative ICT services and offers a solid foundation for the design and examination of the different aspects of the business model, such as the service user, the technology, the organizations, finance and regulations. The STOF model describes the business model based on four perspectives or domains: the Service perspective - a description of the service, the value proposition (the value of the service for users) and the intended audience; the Technology perspective - a description of the required technical functionality and architecture to deliver the service; the Organization perspective - a description of the resources, activities and roles and structure in which the value network partners to provide the service - and the Finance perspective - a description of how the service generates revenue (earnings) and the distribution of costs and benefits among the parties involved in the value network.

Naturally these different aspects will change in the course of an innovation process. The service develops under the influence of input of target users, the choice of technology is changing as a result of learning from experiments and organizations play different roles at different stages. That is why the eHix combines the STOF model with a phasing that provides support for the lifecycle of the innovation process. The five phases of Hettinga (2009) form the basis for the phasing: inventory phase, design & development phase, experimental phase, pilot phase and implementation phase [26]. In the inventory phase the ideas of a new service are created and the needs and requirements

of the users for example are analyzed. In the design and development phase, the technology is designed and developed, and thoughts about the business model of the service are initiated. In the experimental phase users try out the new application in a laboratory setting while in the pilot phase more users are involved testing the application of the service in their daily practice and giving input for a successful implementation in the deployment phase.

The eHix thus combines the five stages in the innovation process (concept phase, design phase, test phase, pilot phase, implementation phase) with the four aspects of the business model (service, technology, organization, finance), resulting in a matrix containing 20 (4 by 5) cells. Each cell contains the essential steps and choices to be made in the innovation process for a specific domain within the business model in a particular phase. For each cell keywords describe the essence of the cell. For each keyword checklists, tools, methods, approaches and examples were collected that support the decision making process to the next step in the innovation process. The content offered by the eHix cells varies. For example, there is a template for conducting a stakeholder analysis, a preparation of a business case, a template to aid in making a technical design and a format to evaluate a pilot.

For the development of the eHix content a thorough study of factors determining the success and failure for e-health innovations was done. The identified success and failure factors are assigned to the various components of the STOF model so the success criteria can be used for evaluation of the business model and also serve as building blocks of eHix itself. The list of success criteria was compiled based on a literature review and several expert meetings wherein insurance companies, entrepreneurs, researchers, health care institutions and government agencies participated. The results of the expert meetings and literature are assigned to the eHix products per fase. The eHix matrix structure is shown below in Fig. 2 with the main keyword in the cell displayed.

1) Designing the Hightech@home care business model with the eHix method

To guide the development of a viable business model, the eHix has been applied to the Hightech@home project, which has gone through the inventory phase and is currently in the middle of the design & development phase. The project's aim is to realize a home care service system as outlined in Fig. 3. This product is at the service of the clients (care receivers). As Fig. 3 shows the service system can be divided into two parts: the left part for the client and the right part for the professional carers / informal carers.

The client's package consists of a smartphone or tablet with which the client can request the assistance of a carer either by 'normal' call or by video call. The two sensors, a GPS and a fall detection sensor in the client's device make it possible to detect the position of the client in case the client is in need of assistance outside of the home. The device of the carer is also a tablet or smartphone; communication with the client is possible and the necessary sensor information (fall detection sensor / GPS) is displayed. So there are three manners to obtain the client / carer information: (a) by video contact: personal communication, (b) GPS: location and (c) by the fall detection sensor: information. The fall detection sensor serves as an example for the possibilities to connect generic sensors. In addition, functions like data mining (eg. filling in data on client and carer) and viewing the logged information are provided for.

2) Service Domain

The first part of the STOF framework describes the service offered, the value proposition and the possible market segments of the Hightech@home care service. The value proposition of the home care service is still hypothetical in this inventory phase and needs to be demonstrated in the experimental phase and pilot phase. The home care service is offered as a technical support service so that the elderly and persons with a chronic illness and/or intellectual disability are able to continue living at home (longer). The support service enables the clients and their professional carer and informal carers to communicate with each other in the traditional way of using a telephone with voice communication, and adds an extra interface of video communication. This extra interface of video communication is expected to provide the client and carer with more information and reassurance.

The GPS and fall detection sensor offer real-time and accurate information on the physical state of the client to the carer. For the client the GPS and fall detection sensor anticipate in a greater sense of safetly and reassurance. With the combination of an extra interface and sensors the home care system is expected to result in a more efficient and effective way of communicating. Making use of open software is anticipated to lead to lower cost of development and higher ease of use for the client (plug-and-play). Appropriately translated by the developers of the home care system the low costs and ease of use could result in a higher quality of care for the clients.

Figure 2. eHix matrix structure combining business model domains with innovation phases
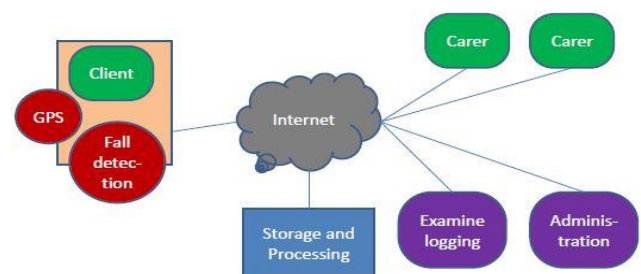

Figure 3. The envisioned Hightech@home care service system

The service also hopes to ensure that the clients will be able to do more themselves or with informal carers, thereby being more independent and requiring less care. This independence is expected to increase the quality of life for the client. The Hightech@home care service also provides extra information by logging the selected sensor data. Analysis of the logged data by the carers can ensure that care is better tailored to the clients' needs.

The Hightech@home service is expected to help professional carers and the informal carers to improve the effectiveness of their care. Expected efficiency, labor savings and increased service levels are all part of the value proposition for the professional care organization, as well as creating a competitive advantage compared to other care organizations with this home care service. The enhanced sense of security that the service offers through real-time monitoring is an important value proposition for both client and informal carer. The hypothetical value proposition has to be validated in the experimental phase and pilot phase.

3) Technology Domain

The next step in the eHix method is the description of the technical functionality required to realize the service. Relevant variables in this technology domain are: technical architecture, network accessibility, needed devices and application. The Hightech@home care service comprises a robust smart phone equipped with sensors (GPS and fall detection sensor), servers for storage and processing of information, and tablets or smart phones to display client messages and other information, see Fig 3. The technology used for the home care service is based on open source software. Even though the web application developed has been used in other projects, the combination with generic sensors has not been proven yet. Reliability is important because the service intents to deliver instant and stable communication between client and carer and real-time and accurate information about the movements of the client.

Beside an impeccable reliability, the home care service needs to meet a number of certifications. There are a number of European requirements for the introduction of home care service [27]. Since the home care service also logs patient data, the law on medical health informatics must also be met [28].

4) Organizational Domain

The third part of the business model contains a description of all the different actors in the network needed to deliver the service and the position of these actors in the value network. First we chart the actors, then we analyze their strategic interests to complete the stakeholder analysis.

The central actor in the Hightech@home care service is the client with a mental and/or physical disability living at home. The client receives care from a professional carer who is employed by a formal care organization and/or from an informal carer. The professional care organization provides care to people with physical and/or mental disabilities in their own living environment. The informal carer is often related to the client, either family or living in the neighborhood. The insurance company and/or the municipality finance or arrange the care and in doing so adhere to the laws and standards promulgated by the government.

The Hightech@home project team acts as the entrepreneur in this case, developing the home care service and the possibilities to market. The team consists of Stichting TriVici, VAC Thuistechnologie, Frion and Windesheim Research group IT Innovations in Health. Stichting TriVici is founded on new concepts and innovations bringing care to people. They provide innovative solution to the Dutch home care market. An example is the development of an open source portal. VAC Thuistechnologie is a consultancy firm in information technology which excels in the home care market based on many years of experience. Frion is a large professional care organization that provides support to people with intellectual disabilities. The Windesheim Research group IT Innovations in Health Care studies the development and use of ICT in healthcare.

When it comes to the interests of the various parties in the network, our starting point in any home care service is the client's concern. The client is interested in the provision of a certain degree of independent living, an effective means of communication, a good quality of life, better safety and more comfort. For the client the home care service obviously has to be easy to use and non-intrusive. With uncertain finance prospects the costs of the service are also a concern for the client. The professional care organization's interest and the formal carer's interests partly overlap with the client's interests: safety, independence, communication and quality of life are part of their main concerns. Putting the clients' welfare first at all times, Frion is looking for innovative ways to let their cients live their lives on their own terms, being in control of their own lives as much as possible. Efficiency, labor savings and increased service levels would be means to reach Frion's innovative objectives. Integration and embedding the service in their existing offerings would also add to reach the care organization's objectives. The insurance company's interest are guided by support among caregivers and clients, health benefits like higher quality of living and self-reliance, reduced health care costs, workload reduction in care and replacement of existing care (substitution). The insurance companies are mostly bound to the national agreements (the Dutch government decides which care is included in the basic package of insured care), but they do look for ways to enhance their image to attract and retain customers. An innovative home care service could be a good unique selling proposition (USP) to them. Besides the government's guidelines, the municipalities are expected to be led by efficiency, cost-effectiveness, necessity and practicality.

Stichting Trivici's interest in the Hightech@home care service is to develop and market a home care system which encourages low cost, interoperability and enables plug- and-play home care technology. Safety, independence, increased service levels and quality of life are the pointers where Stichting Trivici works with. VAC Thuistechnologie is looking for unique solutions to solidify its market position in the Dutch home care market. The Hightech@home project is

a stable starting point for further development of open source home care concepts for this commercial partner. The Windesheim Research group IT Innovations in Health Care aims to provide and produce knowledge on how to design and implement innovative health care solutions and aims to spread this knowledge towards other projects and publications.

5) Financial Domain

On the basis of an analysis of the financial domain, the way the service intends to generate revenues and the way risk, revenues and investments are divided among the various actors in the network, it is clear that there are various revenue models possible, depending on the target group and buyer within this target group.

Central to the Hightech@home care service is the client as target group. This client can be the individual buyer of the home care system. In that case the service can take a revenue from for instance hosting, support service, extensions and other services as we have seen in the examples of open source business models. The fee can take different forms, ranging from subscription based on monthly / yearly fee to a usage fee based on actual services used. There are different levels of subscription possible (basic – premium) and price-wise the client's concern regarding price will probably be leading. The informal carer, another potential target group, can also be regarded as the potential individual buyer. In this case the revenue model could be quite similar to the model in which the client is the one who purchases the system.

Considering the other prospects identified in the service domain, the professional care organization comes to the fore. In case this party decides to purchase the home care service system, the revenue model will be quite different, since we are dealing with an organization instead of an individual. Possibilities of installation / implementation fees, hosting, consulting and support service and organizational customizing with open license or commercial license as shown in the various open source business models come into view. Revenues can be made through various forms from subscriptions to lump-sum delivery with service contracts. In case the care organization has an in-house IT service, a once-off implementation contract also belongs to the possibilities. Although the municipality and insurance companies are not part of the Hightech@home project, it is not unthinkable that they would be interested in purchasing the home care service as an extra facility for their citizens or customers. Since there are large-scale organizations too, revenue forms here could resemble the revenues to begotten from the professional care organization as buyer. The proven model of platform creation for shared services comes into view as a possibility here.

The amount and forms of revenues vary greatly among the different potential target groups and their investment potential. The scale of the implementation and intensity of the use of the services will partly determine the revenue models and thereby the business modeling.

6) Results

Working out the value propositions of the Hightech@home care service in the first step to business modeling, brings the awareness that this intended home care service can add value to more than just the client and carers. Although the client and the carers are the primary target groups, the home care service also has the potential to deliver value for the professional care companies and even to the insurers and the municipality. Straightaway there is the confrontation with the many parties in the home care landscape and with the fact that the target groups have not been determined yet. The intended target groups and their needs are central and largely determine the course of the development of the business model. Therefore there is the need to take action in this first step of the business modeling. Previous assessment showed how complex the Dutch home care landscape is and how different the routes the home care system can take to market. These observations call for the drafting of scenarios per target group to be written out at the outset of the project.

The mapping of intended target groups and their accompanying needs in the scenarios are key to determining the right value proposition per target group for the Hightech@home care system. It is no use to hurrying to phase two – the design phase - of service at this very moment; one is simply not able to determine the user requirements if the target groups and their needs are not known. Unambiguousness at the first phase is obviously fundamental.

The technology scan in the inventory phase of the technology domain focusses on the technical realization of the value proposition of the Hightech@home care system. The first thoughts were on the client and care organization as target groups, and it is clear there has not been enough though on the potential target groups of municipality and insurers yet. All the probable value propositions in the service domain have not been described so far, therefore the technical options for realization cannot be drafted properly yet. For how to know what to develop if it is not clear what the Hightech@home innovation has to deliver? The eHix framework sends us straight back to the first cell of value proposition as a no-go and puts us to the task of charting all the target groups, needs and values per scenario as detailed as possible.

Leaping to the organizational domain, the target groups are joined by the project parties in the value network of the Hightech@home care system. By charting the actors' interests in a complete stakeholder analysis one gets clarity about the joint interests of the parties and is able to value the expertise in the project. Since the technical requirements of the Hightech@home care system are not known in detail yet, one cannot establish whether or not there is enough expertise in the project team. This has to be re-evaluated and may be in need of adjustment after the scenarios in the inventory phase of the service domain have been worked out.

The stakeholder analysis of the project also makes it possible to specify the evidence needed to persuade the potential target groups for the Hightech@home care system. Since this evidence has to be gathered in the experiments and

pilots, it is essential to be clear on the results before setting up the experiments and pilots for the Hightech@home project. The evidence needed will of course vary per scenario. If it turns out that particular evidence needed for a target group – for instance labor savings for the insurer - cannot be established, the evidence may become a determining factor in the selection of scenarios for the Hightech@home care system. The stakeholder analysis is also most useful in selecting the scenarios in the financial domain. The analysis shows the financial potency of the potential target groups within the Hightech@home network. The clients and informal carers obviously have a lower budget to spend than the care organizations, insurers and municipalities. If the Hightech@home project's aimed low-cost care service turns out to be out of reach for them, the other prospects come to the fore. In this manner the stakeholder analysis facilitates the selection of the likely scenarios.

The revenue of the Hightech@home care system and its various forms diverge among the different potential buyers. Purchase and use of the home care system by the individual client or individual informal carer ask for a very different implementation / service model and use than purchase by the professional care organization. When the purchase is made by insurers or municipalities, the scale of service and intensity of use even broadens. At this point in the project one can only make an inventory of the possible revenue models based on literature research of open source models. Only after all the scenarios of the Hightech@home care system are mapped, the revenue models can be identified efficiently and further steps can be taken towards viable business models.

IV. CONCLUSION

The aim of this paper is to elaborate on the factors that play a role in the initial development of a feasible business model for open source home care technology, using the Hightech@home care system as an example. First of all literature overview pointed out the specifics of open source software and business models for open source software. Based on open source software, there are various established business models, from adding services and products around the software and creating platforms to share to hybrid models of open and closed licensing. Creative solutions are already proven according to literature. What makes open source software especially challenging in tailoring it to a market is the numerous actors in the open source software development. The large community of developers and testers of the open source software has to be kept in mind by building flexibility into the business model for the home care technology market.

What characterizes the home care technology market? Literature overview describes the home care market as complex. Especially in the Netherlands the home care market is a fragmented landscape with demanding parties and various routes to this market. To make sure all options are explored, the open source business model for this scenery has to be developed in a thorough and methodical matter,

making sure a solid foundation has been laid in the first stages of the business modeling.

What are the particulars to be considered in the early stages of business model development for open source home care technology? As the first inventory stage of business modeling, charting the value proposition for the Hightech@home care service shows, it is most efficient to first work out a complete stakeholder analysis, followed by all possible scenarios in a consistent manner. Charting the value proposition of the care service brings awareness of other potential target groups which cannot be put aside. The intended target groups are central to the course of the business model. Absolute clarity on these groups, their needs and value propositions is vital before jumping into further development of the business model.

Making choices in the inventory phase is not advisable. On the contrary, the inventory phase is best used to chart the full potential of the home care service. The writing out of scenarios per prospective target group ensures a comprehensive view of the potential of the home care service and a good foundation to develop a vital business model. The analysis of all the stakeholders and their interest in the network also provides the essential criteria for the feasibility of the scenarios. These criteria like income, scale of use or evidence needed for persuasion make it possible to make a preliminary selection of scenarios if necessary or preferred.

The question what business model would be most feasible for the Hightech@home open source technology innovation cannot be answered yet in these early stages of development. This is logical since since not enough research has been done into the full potential of the service. The use of a structured method like the eHix method to build up the business model, a method where one is only allowed to move to the next phase if the previous phase is completed, ensures an efficient and effective route to business modeling.

It is in the nature of business and entrepreneurs to fast track ahead on the road to success. However, laying foundation of business models by starting with an in-depth stakeholder analysis, working with probable scenarios and diligently following a business modeling method is the way to develop feasible business models that show the potential of the innovation to its full advantage.

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