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# Third party developers in Mina VårdKontakter

Opportunities and Challenges

Master's thesis within Informatics

Author: Efstathios Kapaniaris

Liren Yan

Tutor: Christina Keller and Sofie Wass

Jönköping May 2014

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Efstathios Kapaniaris

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Liren Yan

*Jönköping May 2014*

## Master's Thesis in informatics

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Author: Efstathios Kapaniaris, Liren Yan  
Tutor: Christina Keller and Sofie Wass  
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### **Abstract**

E-health has been implemented internationally as a broad range of medical informatics applications for facilitating management and delivery of health care since the beginning of the 2000s. In Sweden, Mina VårdKontakter (Eng. My Health Care Contacts), is an e-health platform providing services nationally in all regions and county councils. In order to provide further features of the platform, third-party developers will be invited to develop parts and features of the system. The purpose of this thesis was to investigate the challenges and opportunities that third-party developers encounter as they aim to contribute to the platform and how the platform owner can provide support for the developers. In order to fulfill the purpose, five qualitative expert interviews were made with three third-party developer, one platform owner and one project manager. The main opportunity that the third-party developers saw was to gain financially from participating in the development of Mina VårdKontakter. The main challenge was the lack of access to real data, as opposed to demo-data, and the still not very developed support from the platform owner, such as the software development kit (SDK) and application programming interface (API). These and other platform boundary resources, such as agreements between developers and owners still need to be developed and communicated to the third-party developers.

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# I Introduction

*In this part of the thesis, an introduction to the study is given. The background, research problem, purpose, research questions, delimitations and main definitions used in the thesis are explained.*

## I.1 Background

The concept of e-health is a relatively new term for both computer and medical sciences (Eysenbach, 2001). The concept has been used since the early 2000s after the explosion of network communications and the spread to a wider part of the population. The renovation of the Internet with the introduction of Web 2.0 (O'Reilly, 2005) technologies gave new possibilities and opportunities and opened new ways to the traditional health care system to use information technology. The definition of the term "e-health" is still under discussion. E-health is a growing field that aligns medical informatics, public health care and business regarding to health services, information delivered through the Internet and any kind of related technologies (Eysenbach, 2001). The term characterizes the technological development, the general attitude about health matters and global thinking in order to improve health care locally, regionally and worldwide by using communication and information technology. Another definition provided by the World Health Organization, states that e-health is the transfer of health resources and health care by electronic means. This is further divided in three main areas (World Health Organization, 2001):

- The access of health care information by medical professionals and medical consumers through the Internet and telecommunications
- Use of IT to improve public health care services
- Use of e-commerce and e-business well known strategies to improve the health care system management.

The Swedish Ministry of Health and Social Affairs focus on e-health (Socialstyrelsen, 2011) by acquiring strategies for accessible and secure spread of information (Ministry of Health and Social Affairs, 2011) partly resulting in the implementation of the e-health platform *Mina VårdKontakter* [Eng. *My Health Care Contacts*]. *Mina VårdKontakter* is an e-health platform referring to people living in Sweden that seeks to enhance the citizens possibility to be liable for their own health (Center för eHälsa i samverkan, 2012). The aim is to ensure efficient information supply in health and social care for both medical professionals and medical consumers. Recently, *Mina VårdKontakter* released of its own Software Development Kit (SDK) as a service to third-party developers wishing to contribute to the development of the platform. It is an opening for the software developer and designer community to help the platform become more mature and enhance the fulfilment of IT resources (*Mina VårdKontakter*, 2013). In this way, third-party developers will be able to contribute with their own work to the Swedish health care system.

In computer science, third party development in software is the development of software by a company or an individual person other than the company that developed the original software (TechTerms, 2009). In other words, it is any kind of external individual, who does not belong to the company's workforce that develops the original software. (Glossary, 2009). The third-party developer contributes with software that, for instance, can be applications, add-ons and plugins. The purpose of these smaller parts of software is to add to the bigger software and also further functionality. This way of working with developers has been used by companies such as Apple or Microsoft. Both of them are developing their own operating system, Mac OS and Windows. As a consequence, we consider them as

first-party developers because they are developing their own software from scratch. Many of the applications that are included or can be installed afterwards, are however not developed by Apple or Microsoft but by a third-party application development company such as Adobe. Furthermore, considering Adobe, their graphics editing software, Photoshop is a stand-alone application that allows users to create or edit images. Besides, it supports third-party plugins which add further functionality. These plugins are developed by other companies than Adobe and they are designed to work with Photoshop. Therefore, they are called third-party plugins.

Mina VårdKontakter is an e-health platform (Mina VårdKontakter, 2013a). An e-health platform is not only a database, in which you could access to your personal health records, but also a way to provide services that could make your health care managed more efficiently. Based on the technologies, patients who are registered in the platform, could track their medical records, book times for doctors' visits and any other kind of medical service a health care center can provide. The rule of thumb is that a patient platform provide a better, more effective way for patients to share real-world health experiences in order to help not only themselves but other patients with the same medical conditions (Patientslikeme, 2004). By means of the e-health platform, doctors and researchers have the access to patients' data and give them the opportunity to continue their further research to fight diseases. Boaz Carmeli, a healthcare researcher at IBM Research explains this in the following way: *"Data from patients is a gold mine that helps us discover ways to treat other cases more successfully."* (Carmeli, 2012, p.39).

The purpose of an e-health service is to give the opportunity to the patient to modify, delete, and update a calendar with the collaboration of the physician, who from his side can decide when the patient should pay a visit. With the help of the e-health platform, doctors can also track what medicine should be taken by the patient and, on the other hand, the patient can keep track of records regarding the costs of the treatment (medicines, therapies etc.). *"The clinical trials don't cover all populations and other evidence doesn't take into account factors such as the patient's emotional state, lifestyle, family history, or genetic profile"* (Ranerup, 2011, p.46). Now, with the help of patient platform, doctors do not have to treat their patient on a 'guess-based medicine'.

## **1.2 Problem**

Mina VårdKontakter is a non-profitable national service that now seeks to include developers outside the traditional healthcare sector through open innovation. The rapid development of new technologies has given developers the chance to do what are really interested in and what makes them respected in the community of developers (King, 2013). However, it is still unknown if there is any interest in contributing to the delivery of new solutions in the context of a public non-profit healthcare organization. Therefore, we will investigate the rationale behind why third-party developers would want to contribute to Mina VårdKontakter.

## **1.3 Purpose**

The purpose of this thesis is to investigate the challenges and opportunities that third party developers encounter as they aim to contribute to an e-health platform for open innovation and how the platform owner can improve the support for third-party developers.

## **1.4 Research questions**

Our thesis dedicates in answering these following questions:

- What interest do third-party developers have to participate in the development of services in Mina VårdKontakter?
- What opportunities and challenges do they see after their participation in the project?
- What can be improved from the view of a third-party developer regarding software development kits?

The first two questions are focused on the perceptions of the third-party developers themselves to understand their thoughts and motives behind. The difference between RQ1 and 2 is RQ 1 focus on the period before third-party developers participate in Mina VårdKontakter and RQ2 focus on after they participate in Mina VårdKontakter. The third research question is viewing this project from the specific perspective of support to the third-party developers' actual work with software development.

## 1.5 Delimitations

We will not examine or compare the platform with other e-health platforms inside or outside of Sweden. Moreover, we will not provide any description of the current state of the platform regarding the developmental part. The data was collected during the spring of 2014 from Swedish developers and project managers which were interested in contributing to Mina VårdKontakter by submitting their own contribution.

## 1.6 Definitions

**E-health:** e-health is an emerging field in the intersection of medical informatics, public health and business, referring to health services and information delivered or enhanced through the Internet and related technologies (Eysenbach, 2001).

**Platform:** As early as 1574 the Oxford English Dictionary cites examples in which “platform” refers to “*a design, a concept, an idea or a pattern.*” This concept has been thoroughly developed by researchers in three overlapping research settings: product development, technological strategy and industrial economics (Baldwin & Woodard, 2009).

**Software platform:** “*The extensible codebase of a software-based system that provides core functionality shared by modules that interoperate with it and the interfaces through which they operate*” (Tiwana et al., 2010, p. 676).

**E-health platform:** A software platform for the development of e-health services.

**Mina VårdKontakter:** The Swedish e-health platform. Mina VårdKontakter is a national health service available to all people living inside Sweden. Everyone who has access to the platform can contact its local health care center and ask for health services such as prescriptions and book time with doctors (Mina VårdKontakter, 2013a).

**Application Programming Interface (API):** “*A language and message format used by an application program to communicate with the operating system or some other control program such as a database management system (DBMS) or communications protocol.*” (PC Magazine Encyclopedia, 2014).

**Open innovation:** Open innovation is the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively (Chesbrough, 2006).

**Platform boundary resources:** Resources provided by platform owners to shift design capability to third-party developers (Von Hippel & Katz, 2002) and facilitate the use of the

platform's core functionalities and the deployment of applications (Baldwin & Woodard, 2009; Gawer & Cusumano, 2008; Tiwana et al., 2010; Yoo et al., 2010). Boundary resources can be technological, such as software development kits, or social, such as incentives, property rights and agreements (Ghazawneh, 2012).

**Software Development Kit (SDK):** A software developer's kit (SDK) is a set of programs used by a computer programmer to write application programs (Rouse, 2008).

**Third-party development:** *“An innovation network distributed across multiple actors and technologies.”* (Ghazawneh & Henfridsson, 2010, p. 4).

## 2 Frame of Reference

*In this chapter, the theoretical foundations of the study are presented; e-health, open innovation and third-party development. Within the section of e-health, the Swedish national strategy of e-health is presented and the e-health development project of Mina VårdKontakter is introduced.*

### 2.1 E-Health

”E-Health” is a relatively new term without an unambiguous definition (Eysenbach, 2001). Eysenbach provided one of the first definitions of the concept of e-health in the beginning of the 2000s. According to him e-health is *“an emerging field in the intersection of medical informatics, public health and business, referring to health services and information delivered or enhanced through the Internet and related technologies. In a broader sense, the term characterizes not only a technical development, but also a state of mind, a way of thinking, an attitude, and a commitment for networked, global thinking, to improve health care locally, regionally, and worldwide by using information and communication technology”*. (Eysenbach, 2001). Statistic reviews have shown that this is the most widely used definition to describe e-health.

In the middle of the 2000s the “e” became mostly considered as “electronic” and as a consequence the term, was widely used as *electronic health* (Oh, Rizo, Enkin, & Jadad, 2005). By combining the existing definitions, Pagliari et al (2005) tried to give a clearer and more accurate definition. The effort resulted in a definition that considers e-health as *“a broad range of medical informatics applications for facilitating the management and delivery of health care”* (Pagliari, o.a., 2005).

On a more official level, according to WHO, e-health is the transfer of health resources by electronic means and it consists of three main areas (World Health Organization, 2001):

- The delivery of health information to medical professionals and consumers through the use of the Internet and telecommunications
- Using the IT to enhance the public health services
- Use the best practices of e-commerce and e-business in health systems management

#### 2.1.1 The E's of E-health

Eysenbach defines the 10 “e’s” of e-health in order to clarify what best characterizes the term e-health. The word “electronic” is the most widely used word that stands for “e” but it cannot explain alone what e-health is and does. As a consequence, a number of “e’s” are issued to give a better view of the term (Eysenbach, 2001).

- Efficiency: Decreasing the costs by enhancing the communication lines between the health care entities, which would restrict duplicate and unnecessary interventions. The involvement of patients is also of crucial importance.
- Enhancing quality: The reduce of the costs should not have a negative result on the quality
- Evidence based: E-health interventions should be evidence-based on scientific evaluation.
- Empowerment of consumer and patients: The patient empowerment is a subject of research for years with the roots of first references found on the middle 90’s. Until today it is hard to find a real definition of the term. The most efforts resulted con-

cluded that the patient empowerment is a situation where the patients are involved actively to their own health management (Monteagudo & Moreno, 2005). Another definition suggests that the patient empowerment is the active participation of the citizen in his/her health and care pathway with the interactive use of Information and communication technology (Bos, 2007).

- Encouragement: Patients and health professionals should be able to collaborate and take decisions in a shared matter.
- Education of the medical professionals and consumers through online sources
- Enabling the information and communication exchange between health care entities.
- Extend the range of health care. This mean the possibility that is given to medical professionals and consumers to access medical services from anywhere by the use of internet and telecommunications.
- Ethics: E-heath provides a new way of interaction between the users (professionals and patients) and points new issues such as online professional practice or privacy
- Equity: the access to health care must be equal to everyone. This is an area that e-health may be the problem not the solution. This could happen as not everyone has access to a computer or a network and as a result they cannot benefit from the e-health services.

Except from this 10 “e’s”, Eysenbach provide four more sub-suggestions:

- Easy to use: The users of the system should find the information they want easily without complex and unclear procedures
- Entertaining: They system must be user-friendly and attract the user
- Exciting: The user experience must be as high as possible
- And finally it should exist

### **2.1.2 Goals of E-health**

Developing a new strategy in the area of healthcare would face many implementation challenges. To deal with that, a set of goals must be set in order to be successful in strategy implementation. The empowerment of the patients is one of the major challenges that an e-health system must deal with. Without patient involvement the system has no purpose of existence. Furthermore, it has been asserted that one of the important challenges is the infrastructure of the system. The system design should take into consideration issues of safety and availability of private data. The whole concept of e-health is around three rules: availability for anywhere, by the right person, at any time needed (Rosenälv & Lundell, 2012).

The specific goal of e-health is to improve the traditional health care system. Breaking this goal into parts, it is possible to identify the need for removal of inequities, inefficiencies, low quality and inadequate distribution of health resources (Wickramasinghe, Fadlalla, Geisler, & Schaffer, 2004). The development of an e-health system should support the secure sharing of health information with purpose to improve the healthcare quality, reduce the costs and provide that everyone has an access to healthcare (Ma & Zhu, 2005).

The developing of an e-health system is not, of course, something that it can be done from one day to another. It is in reality a long-term scientific and technological plan that must be carried out by professionals with the focus on implementing the specified goals (Rosenälv & Lundell, 2012).

### **2.1.3 Personal health records**

The main content of an e-health platform is one's personal health record which you can not only read and check, but also track, modify and share. A personal health record includes all aspects that relate to the individual status (Mayo Clinic, 2004). The start of personal health records was the so-called computer-based personal records (CPR) which came into the surface in the beginning of the 00's. Institute of Medicine committee believed that CPRs and CPR systems had a unique potential to improve the care of both individual patients and populations and, concurrently, to reduce waste through continuous quality improvements (Dick & Steen, 1997). Nowadays, with the development of technology and IT infrastructures, patients can have fully access to his personal health record all over the world. Personal health records (PHRs) is a tool that you can use to collect, track and share past and current information about your health. PHRs are centralized places for consumers to electronically store, manage, and share their personal health information, offer new opportunities to help consumers manage their own health and health care (Li, 2013).

Healthcare should always be citizen-centered (Nykänen & Seppälä, 2012) and make the navigation through the health care system more efficient. The personal health record (PHR) is one of these tools that can support this. Each individual must have and control his/her own PHR and access it private and securely from any place at any time (Markle Foundation, 2003). PHR is considered as a powerful tool that allows patients to manage their own health (Nykänen & Seppälä, 2012). Moreover, PHR can support decision-making by the patients and creates a complete view of their health and wellness (Detmer & Steen, 2006). The information recorded in a PHR can be clinical data from different health care providers but they can also include data from the patient themselves. All this information are stored under the authority of the PHR owner. In other words, the patient is the only one that is authorized to enter records to his/hers PHR. If a third person wants to modify a PHR must have the authorization of the owner. A PHR system can have three different approaches (Detmer & Steen, 2006):

**Standalone PHR:** Records that are collected and stored by patients in private storage means (personal computers, external devices even paper), they have full control of the records and they are not connected with any system.

**Tethered PHR:** Patients can view their own information from healthcare's electronic health record (EHR, examined below) but they do not have full control of the recorded information.

**Interconnected PHR:** A transformation of the standalone PHR. The difference is that the PHR is stored to a centralized storage system and it can be access from different locations and individuals that have the authority to access this record.

### **2.1.4 The National Swedish Strategy for E-health**

The National Strategy for eHealth was developed at the request of the Swedish Government during 2005 and 2006 after national consensus was reached on the need to develop and introduce nationally coordinated ICT support and more integrated information management. The objective was to improve and renew health and social care putting the needs

of the individual first. The Strategy was adopted during the spring of 2006 as a result of decisions by the Swedish Riksdag and by the boards of the Federation of Swedish County Councils and Swedish Association of Local Authorities. A National High-Level Group for eHealth was established with representatives from the Ministry of Health and Social Affairs, the Swedish Association of Local Authorities and Regions (SALAR), the National Board of Health and Welfare, The Medical Products Agency, Apoteket AB and Carelink. Within six months, all of Sweden's county councils and regions had decided to adopt and implement the national strategy into their own activities, which had a huge impact on its development (Ministry of Health and Social Affairs, 2010).

In 2010, the Swedish Government adopted a revised version of the National e-health strategy. The Swedish strategy for national eHealth focuses on how healthcare can be improved by means of e-health services and target benefits for three main stakeholders; patients, health professionals and policy-makers in healthcare:

*“The individual in his or her role as citizen, patient, end-user and close relative/friend shall have access to easily accessible, quality-assured information on all forms of health and social care as well as access to documentation on previous care interventions and treatments. He or she shall be offered customised service and interactive eServices in order to be able to participate and exercise self-determination based on his or her own prerequisites.*

*Health and social care staff shall have access to well-functioning, concurrent electronic decision support that both guarantees a high level of quality and security and facilitates their day-to-day work. Necessary and structured information shall be available as a basis for taking decisions on care interventions and treatments.*

*Decision-makers in all care services shall have the appropriate tools to continuously monitor the quality and security of activities and obtain an up-to-date and comprehensive basis for taking decisions on organisational governance, planning and resource allocation. Public and private research shall have easy access to high-quality data, with total respect for citizen integrity.”* (Ministry of Health and Social Affairs, 2010).

From the patient empowerment perspective, the strategy aims for personal e-services for all citizens, interactive services for patient participation and web-based support for free choice of care provider (Ministry of Health and Social Affairs, 2010). In this context, Mina Vård-Kontakter could be categorized as an interactive service for patient participation. E-services aimed at patients, health professionals and policy makers are further described in figure 2.1.

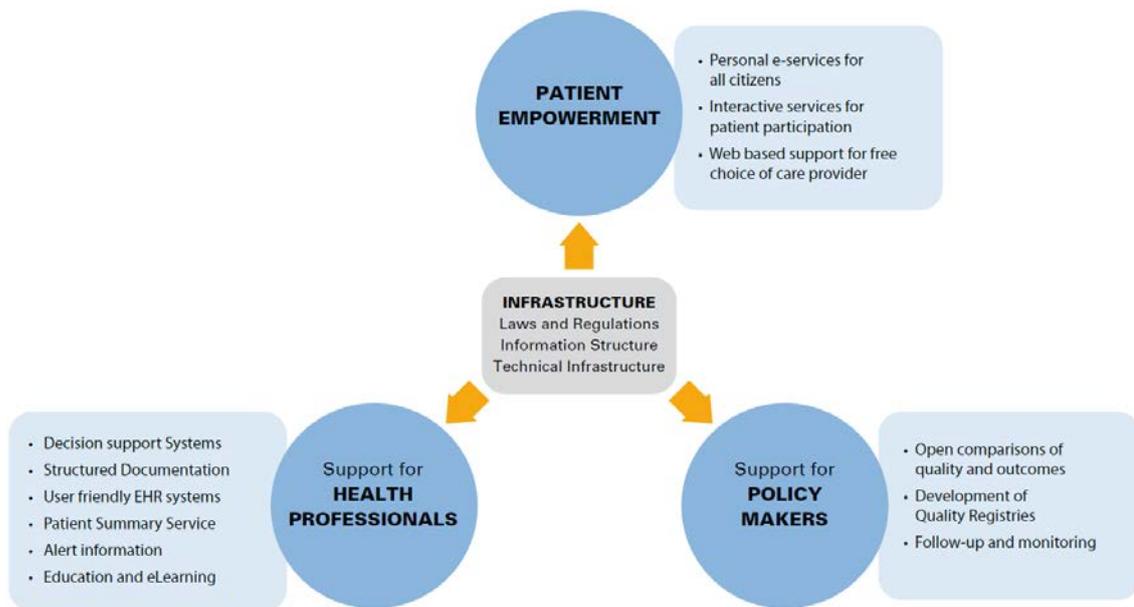


Figure 2.1 E-services aimed at patients, health professionals and policy makers according to the National Swedish E-health Strategy (Ministry of Health and Social Affairs, 2010).

### 2.1.5 Case Description: Mina VårdKontakter

In October 2002, the new e-health platform of Sweden, Mina VårdKontakter was released in ten pilot units around the country. The platform was an extension of the system Vårdguiden (health guide). Vårdguiden started as a telephone service on October 2001 and its web services were launched on December of the same year. Mina VårdKontakter developed with purpose to improve and enhance the quality of healthcare provided to patients. The pilot program was around 10 healthcare centers and in the first months of use the results were more than promising (Westelius, 2007). The whole project started to expand to more healthcare centers around Sweden in the next years.

After more than 10 years, Mina VårdKontakter is the de-facto e-health platform of Sweden (Mina VårdKontakter, 2013a). Through the platform a patient can request, re-schedule or cancel appointments with medical personnel, request prescriptions and ask for a healthcare center to contact him/her. Each local medical centre decides which services patients can receive from them via Mina VårdKontakter (Mina VårdKontakter, 2013a).

All information transfer is protected (encrypted) and meets public health system standards for security and confidentiality. Using the service is free, but if your query leads to an appointment or a refilled prescription, your county council's fees and rules will apply (Mina VårdKontakter, 2013b). The SDK provides developers access to API which gives access to open and patient data. The API, or application programming interface, specifies how softwares could communicate with other softwares. The service platform allows information exchanging between different IT systems of healthcare field. Each services connected to the service platform complies with contract which specifies how information transferred.

The development project of Mina VårdKontakter is financed by the Swedish research financier Vinnova as a part of an overarching project called Mina Vårdflöden. Besides Mina VårdKontakter, the overarching project also include development of technological infrastructure and research (Vinnova, 2013).

## 2.2 Open innovation

Open innovation is defined as the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively (Chesbrough, 2003). According to Chesbrough (2003), there are four types of organisations that generate innovations; innovation explorers, merchants, architects and missionaries. *Innovation explorers* typically performs the discovery research function that formerly took place in research and development departments. The *innovation merchant* must also explore innovations, but above all focus on a narrow set of technologies that are codified into intellectual property and sold. *Innovation architects* develop architectures enabling other companies or communities to provides pieces of the system, while ensuring that those parts fit together in a coherent way. Finally, *innovation missionaries* consist of people and organisations that create and advance technology to serve a cause, not to make profit. The road to open innovation is not easy. It has its positive effects but has also some drawbacks that companies must be aware of before making the step into it. A firm can benefit by the early involvement of new technologies and opportunities (Van de Vrande, Vanhaverbeke, & Chesbrough, 2008). This is done by making investments to new and promising technologies developed by smaller companies like start-ups or being a part of venture capitals (Ahari, 2007). Besides, this reduces the costs as the company does not need to run internal R&D processes. Furthermore, a company can deliver what its customers want (Marais & Schutte, 2009). As a result, from one side the research costs are reduced and from the other side the profit is raised by the deliverance of a product derived directly from customers' needs. Open innovation has proved to be more accurate and oriented to customers' needs and the delivery of the product to the market is done by speeded up procedures in accordance with the closed innovation model (Van de Vrande, Vanhaverbeke, & Chesbrough, 2008).

The open innovation, on the other hand, holds also some dangers which would result in the opposite result than the expected. The leak of internal information is one of the most serious dangers (Enkel, Gassmann, & Chesbrough, 2009). When a company opens to the public it must provide some internal information and data. This kind of data must be chosen very carefully in order to not expose crucial information to external parties. Moreover, there are matters of who holds the patent for the new product (West, 2005). The companies should have special agreements with their external contributors on who will have the rights on the product. Finally, there are concerns on how a new product from an open innovation community can benefit a mass majority of customers and not only a small portion of it (West & Gallagher, 2006). Companies open their gates to the community in order to gain a high profit from it. If this cannot be achieved, the open innovation project is considered as failed as it is not benefit the majority of the customers which is the main target on the market.

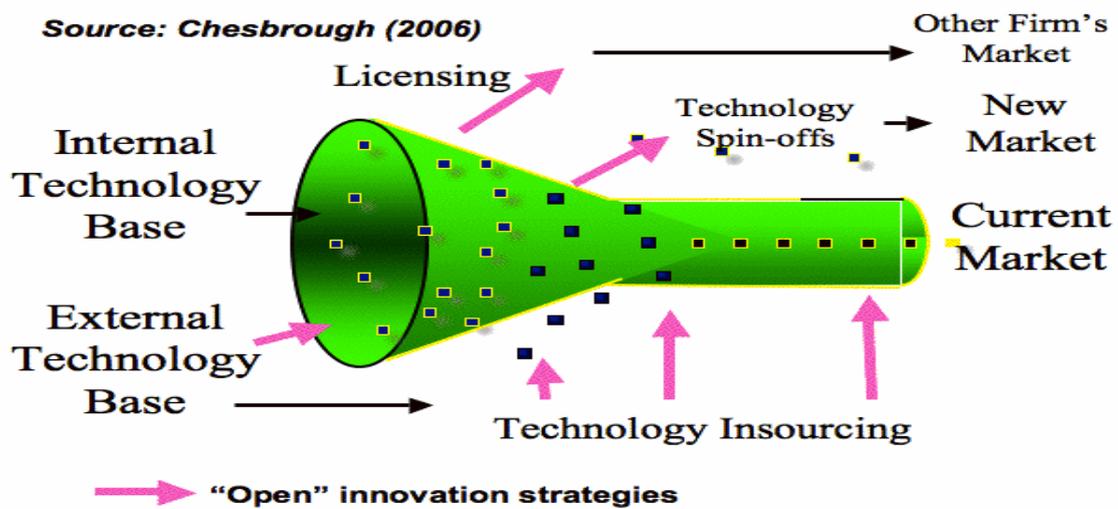


Figure 2.2 Open Innovation Funnel (Chesbrough, 2006).

The open innovation funnel (see figure 2.2) demonstrates how the development processes function. In the one edge of the funnel, internal and external knowledge is gathered. After that step, the knowledge is filtered and the useful information is screened. Those information are intended to enhance the products development. Finally, the last challenge is to transform this knowledge to the final product according to the objectives that was settled when the project was approved.

### 2.3 Third party development

Third-party development can be defined as *"An innovation network distributed across multiple actors and technologies."* (Ghazawneh & Henfridsson, 2010). In this respect, third-party development can be regarded as one type of open innovation.

The term "third-party developers" is widely used the last two decades and it is closely connected with open innovation. Third-party developers in computer science is any individual or any company that develops a software or an application that will be part of a bigger software owned by another company (Kayne, 2014). The new applications are considered as third-party applications, which can have the form of plugins, add-ons or standalone programs inside the software. For example, the operating systems of Windows, Mac OS and Linux are developed by companies or communities. These are considered as first party developers that are developing the original software. Inside this software, there is a huge variety of other applications that were not developed by the original software companies. Mozilla Foundation develops applications like Firefox and Thunderbird, which are installed and used inside the above operating systems. These applications are considered as third-party applications developed by third party developers.

Third-party developers are connected to the open innovation concept. The third party developers became part of open innovation in software when software companies opened up their resources outside the company borders allowing more people to get involved with new ideas and skills. In today's software development practices, open innovation is a radical shift in the development of new products and creates new ways in which science and

technologies are involved in the development of societies and economies (Hanganu, 2013). Since the beginning of the open-source software development movement, developers have contributed freely to the advancement of software, sharing knowledge with each other. Von Krogh (2003, p. 15) offers this explanation for this phenomenon: “... *I suggest that open-source software developers freely reveal and share because they garner personal benefits from doing so, such as learning to develop complex software, perfecting expertise with a computer language, enhancing their reputation, and for pure fun and enjoyment. Many of these benefits depend on membership in a well-functioning developer community.*” The importance of this community is stressed in a research study of Linux developers performed by Hertel, Niedner and Herrman (2003). They found that the more the developers identified themselves as “Linux developers”, the more they contributed to the development.

### **2.3.1 Platforms**

According to the Oxford English Dictionary, the word “platform” has been used since the 16th century to denote “a raised level surface on which people or things can stand, usually a discrete structure intended for a particular activity or operation.” (Oxford Dictionary, 2009). The platform defines a standard around which a system can be developed. Once the platform has been defined, software developers can produce appropriate software and managers can purchase appropriate hardware and applications. The term is often used as a synonym of operating system (Webopedia, 2014). A platform serves no direct purpose to end users itself. It does provide infrastructure for one or more applications (which do serve a direct purpose to end users) (Foster, 2011). More recently, the concept of a platform has been developed by management scholars in three overlapping waves of research, respectively focused on products, technological systems and transactions (Baldwin & Woodard, 2009).

A computer platform generally means the operating system and computer hardware only. The platform conforms to a set of standards that enable software developers to develop software applications for the platform. These same standards allow owners and managers to purchase appropriate applications and hardware (Janssen, 2005). Computer platforms can be either software or hardware and can build on one another in layers. Computer platforms are used as a framework onto which other programs are built (Hazel, 2009).

Mina VårdKontakter, as a typical software platform, is a major piece of software, as an operating system, an operating environment, or a database, under which various smaller application programs can be designed to run (Dictionary, 2014).

The owner of Mina VårdKontakter encourages outsiders to develop complements to the platform. Outside complementors can be of great value to the system when there is a lot of “option potential” in the complementary modules. An option is “the right but not the obligation to take a specific action,” in this case, choose one complement over another. Option value is low when consumer tastes are homogeneous and predictable, and designs are on a tightly determined technological trajectory (Dossi, 1982). Outside complementors will be attracted to the platform if there is option value in the complements, provided the platform owner does not expropriate all the value they create (Baldwin & Woodard, 2009).

### **2.3.2 The Integration of third-party developers by platform boundary resources**

When a new service or product is developed, it is of crucial matter to be customer-oriented and to understand the users’ needs in order to fulfil them (Hippel & Ralph, 2002). For that

reason, companies are turning to open innovation and make efforts to adopt third-party development.

To achieve this goal, resources provided by platform owners to shift design capability to third-party developers (von Hippel & Katz, 2002) and facilitate the use of the platform's core functionalities and the deployment of applications (Baldwin & Woodard, 2009; Gawer & Cusumano, 2008; Tiwana et al., 2010; Yoo et al., 2010). Boundary resources can be technological, such as software development kits, or social, such as incentives, property rights and agreements (Ghazawneh, 2012).

In other words, this helps the third-party developers to integrate to the software development by implementing add-ons and plugins that will later become part of the bigger ecosystem (Ghazawneh A. , 2012). This approach gives third-party developers the ability to access the source code of the software, securely, without modifying it, and allows them to offer their own contributions.

Today, the available technical boundary resources for third-party developers consists of software development kits (SDKs), Application programming Interfaces (APIs), guidelines to the development needs and documentation (Yoo et al., 2010). The boundary resources give the possibility to external developers to have access to the platform and develop new applications while the platform owners can observe the development procedures and have full control of the accessed resources. Each company that wants to do a step towards the open innovation and adopt third-party applications to their system, release one or more of the above resources.

### **2.3.3 Third-party development and open innovation in e-health**

Research studies that medical personnel have lack of understanding of patients view. It is, as a consequence, a need for import of knowledge from external flows (Bullinger, Rass, Adamczyk, & Moeslein, 2012).

Third-party developers and open innovation are terms that are not, until recently, related with e-health. This is because mainly of the variety of issues that should be handled like the secrecy of patient data or security and stability of the system (Hanganu, 2013). The efforts for the integration of open innovation in e-health started in 2007 in USA. It was then when the US government promoted the idea of a free and open source software (FOSS) in e-health (Vetter, 2009).

In Sweden, the process of open innovation adoption began in 2009 under the project "Patient Innovation System for Better Health by Evidence-Based Knowledge" under the surveillance of Karolinska Institutet in Stockholm. The idea behind this project was to improve the quality of the healthcare by acquiring knowledge by the patients add conclusion results (Keller, Edenius, & Lindblad, 2010).

In the way to open innovation in healthcare there are some barriers that it is a necessity to overcome. In their study, Keller pinpoints four targets in order to accomplish this step (Keller, Edenius, & Lindblad, 2010):

- Creation of online communities where patients can add their experiences of their healthcare
- Care providers should have a common strategy on a national level
- The healthcare sector needs to be improved on knowledge gained from innovation
- Support from all involving sides (medical personnel, financial providers etc.)

According to Keller et al. (2010), the main barrier of open innovation in healthcare contexts is a traditional organizational culture of closed innovation, where only formal professions hold valid knowledge. The main driver of open innovation in healthcare was found to be “the empowered patient”, holding a good knowledge of his or her own disease. This kind of patient will take an active part in planning and decisions of healthcare.

### **2.3.4 Software Development Kit**

The concept of Software development Kit (SDK) is a relative new term in computer science. Its appearance to the scene is equal to the appearance of open innovation. It was in the beginning of the previous decade (2000-2009) when the open innovation concept became familiar as a success factor to the implementation of new products and services in the industries of any kind (Innoget, 2009). The computer science could not stay outside this explosion and took the opportunity to collaborate with people outside their borders. The demand and implementation for new services derived directly from consumers, giving them the opportunity to develop their own idea of what they want.

This perspective attracted the software development companies. The idea of using externals to develop new software features for them would have great benefits for them. Benefits like importing new ideas and reducing the development costs. Contrariwise to the development of other products and services (non-software, real products), the software development community had a crucial issue to deal with: how they could allow an external to use their code. This was an issue not only of stealing code, but also of security matter. In this problem the solution is the SDK.

An SDK is generally a collection of libraries, tools, documentation, code samples and application programming interfaces (APIs) to help programmers to write their own applications (Blackwell, 2005). Each software development company that wants to involve third party developers in their system implementation, release an SDK. Today we can find a variety of examples. Software companies like Google and Apple have their own SDKs for software development of new applications, which will be integrated on their system.

### **2.3.5 The SDK of Mina VårdKontakter**

The need for open innovation could not let indifferent the e-health area. Around the world and especially in Europe Union (EU) and USA, efforts have been taken place for the adoption of open innovation in e-health that would offer real opportunities and impacts, improving the quality along the value chain (iNnovaHealth, 2012). The Swedish healthcare system, aware of the challenges now facing in e-health, turns its view to open innovation by releasing their own SDK (Mina VårdKontakter, 2013). The lack of resources, time and funds was the driver issue for this release. The idea behind the release is what open innovation represents: creation of new innovative solutions. The current state of the SDK (Spring 2014) includes descriptions, support and code samples for third party developers in order to develop their own applications for the system.

To examine in more depth, the SDK contains a collection of APIs, which provide healthcare data available for third-party applications. These APIs are of two different types (karolinska institutet) (Lind, 2013):

- APIs for public data: These APIs contain services for contact information of healthcare providers
- APIs for patient-related data: Services regarding the interaction of the patients with the system as regards personal records like appointment scheduling

There are issues as concerns security, as the development of new features requires access to private data. To solve this issue, a secure information infrastructure was designed. The design contains four basic services that ensure the proper integration to the system. These four services are (Lind, 2013):

- Security Service: an API gateway is used as a security connection between the third-party developers and the EHRs, providing anonymity and secrecy of the data.
- Template service: A generic service for development of the user interface
- Resource state service: The service that tracks patient data in all databases connected to the system
- Integration service: This services ensures the mapping of the databases to the service standards defined by the national e-health strategy

## **3 Methodology**

*In this chapter, we describe the research strategy, methods for collection and analysis of data.*

### **3.1 Qualitative versus quantitative research**

Research methods are separated into two categories, qualitative research and quantitative research. Qualitative research methods were developed in the social sciences to enable researchers to study social and cultural phenomena. Examples of qualitative methods are action research, case study research and ethnography. Qualitative data sources include observation and participant observation (fieldwork), interviews and questionnaires, documents and texts, and the researcher's impressions and reactions (Myers, 2009).

The motivation for doing qualitative research, as opposed to quantitative research, comes from the observation that, if there is one thing which distinguishes humans from the natural world, it is our ability to talk! Qualitative research methods are designed to help researchers understand people and the social and cultural contexts within which they live (Kaplan & Maxwell, 1994).

Quantitative research focuses on numbers or quantities. Quantitative studies have results that are based on numeric analysis and statistics. Often, these studies have many participants. It is not unusual to have over a thousand people in a quantitative research study. It is ideal to have a large number of participants because this gives the analysis more statistical power. A goal of quantitative research is to choose a sample that closely resembles the population. Qualitative research does not seek to choose samples that are representative of populations (Henninger, 2009).

In this thesis, we conducted qualitative research since the focus was to get an in-depth understanding of why third-party developers are willing to participate in the project and the challenges and opportunities that the encounter.

### **3.2 Research strategy**

The research strategy of this study was a qualitative interview study with expert interviews from a narrative perspective. Since we needed in-depth information and needed to collect data in a short period of time, we engaged experts to support our research. All expert interviews had the character of a two-way dialog (Goldsmiths, 2009).

The most important thing when applying the expert interviewing strategy is to define the 'expert'. An expert has special "expert knowledge" which is related to a special professional field. It includes expertise as well as implicit/tacit knowledge about maxims of action, rules of decision-making, collective orientations and social patterns of interpretation (Littig, 2013). The five interviewees we chose were participating in this project in different ways. Three of them were third-party developers, one is project manager and the other one is platform developer. All of them have at least more than ten years experience in developing or managing project. Developers in our interviews had all experienced SDKs/APIs in other open innovation projects and successfully conducted their development. They had solidly developed skills to handle tasks in Mina VårdKontakter. The project manager in our interview also had ten years experience in system developing in eHealth.

## **3.3 Data collection**

### **3.3.1 Interviews**

Qualitative interviewing techniques help researchers to observe and record a subject's unique perspective or experience as it relates to a particular issue. The approach allows the subject to provide a firsthand, first-person account. This gives the interviewer insight into where a subject is coming from, rather than getting “yes” or “no” answers that provide incomplete feedback (McQuerrey, 2012). Another advantage of interview in qualitative research is collecting of detailed data for further study. The interviewer is able to gather complex, in-depth data that is not as easily obtained through questionnaires or question-and-answer interview approaches. In many instances, a primary question will lead a subject to discuss related issues that the interviewer can then follow up on with a secondary line of questioning (McQuerrey, 2012).

Qualitative interview is an effective way to study the research questions we mentioned above in this thesis. The qualitative research interview seeks to describe and the meanings of central themes in the life world of the subjects. The main task in interviewing is to understand the meaning of what the interviewees say (Kvale, 1996). According to Rubin Herbert and Rubin Irene, the way we interview depends on what we want to know. It's a process of finding out what others feel and think about their world. The result is to understand the major points of their message and how it compares [similar & different] to your own situation. Not only do you need to be a good conversationalist, but also a good listener (Rubin & Rubin, 1995).

There are some strengths and limitations when one is doing interviews to generate data. The biggest advantages is that you can see through others' eyes. Closed, fixed-response interview - where all interviewees are asked the same questions and asked to choose answers from among the same set of alternatives. This format is useful for those not practiced in interviewing (Dublin Institute of Technology, 2010).

Semi structured interviewing is an overarching term used to describe a range of different forms of interviewing most commonly associated with qualitative research (Mason, 2004) With semi-structured interview, authors had the chance to access to more depth information, understand interviewees' perspectives and experience and because the order of questions is not fixed, flow and sharing of views are more nature (Hardon, Hodgkin, & Daphne, 2004). Semi-structured interviews are often the sole data source for a qualitative research project and are usually scheduled in advance at a designated time and location outside of everyday events. They are generally organized around a set of predetermined open-ended questions, with other questions emerging from the dialogue between interviewer and interviewees. Semi-structured in-depth interviews are the most widely used interviewing format for qualitative research and can occur either with an individual or in groups (University Community Centre, 2010)

Since we have only one chance to interview experts, according to (Bernard, 1998), semi-structured interviews are most appropriate to use when you won't get only one chance to interview someone and when you will be sending several interviewers out into the field to collect data. We used semi-structured interview in order to prepare for our interview and, at the same time, it allowed our interviewees to have the freedom to express their thoughts.

Expert interview, also known as “elite interview”. According to Dexter (Dexter, 1970), “*It is an interview with any interviewee... who in terms of the current purposes of the interviewer is given special, non-standardized treatment.*” i.e.:

- Stressing the interviewee to structure the account of the situation
- Encouraging the interviewee to structure the account of the situation
- Letting the interviewee introduce to a considerable extent ... his notion of what he regards as relevant...

In order to collect data, we needed to find the developers that have developed or declared interest to develop an application for the Mina VårdKontakter. We communicated with the platform developers in Stockholm and they informed the third party developers about our research. From them 5 out of a total 20 registered developers declared interest to participate and give us an interview. We decided, also to have an interview with the platform developer, so we could get a better view of the SDK, its development and its future potential.

All in all, five respondents were interviewed; three third-party developers, one project manager and one platform developer. Three interviews were performed by means of Skype, one by telephone and one interview was conducted face-to-face (for description about the interviews, see table 3.1). All interviews were audio-recorded and transcribed.

Table 3.1. Description of interviews

Interviewee/ Role	Interview duration	Type of interview
Third-party developer A	33 min	Skype
Third-party developer B	27 min	Skype
Third-party developer C	30 min	Skype
Project manager	28 min	In person
Platform developer	25 min	Phone

For our research, we needed two different groups of questions. The first group of questions was for the third party developers (Appendix A). The aim of the questions was to get information about their experiences and why they decided to develop for the platform. The second group of questions was for the platform developers (Appendix B). The purpose was to get some inside information about the development of the platform, get their views on how to attract third party developers and what is their objectives for the future.

### 3.3.2 Secondary data

The authors used the Google Scholar, the databases of Jönköping University Library, published magazines and articles from newspaper as our approach to gather literature related to our study. After we identified our problem and focused on our research problems, the literature search was narrowed to seeking knowledge on third-party developers’ experiences in software development. The key word we used to search in Jönköping University Library databases and Google Scholar were: “third-party developer”, “platform”, “open innovation”, “personal-electronic health records”, and “e-health”.

## **3.4 Data analysis**

### **3.6.1 Qualitative data analysis**

Qualitative data analysis is the range of processes and procedures whereby we move from the qualitative data that have been collected into some form of explanation, understanding or interpretation of the people and situations we are investigating. Qualitative data analysis is usually based on an interpretative philosophy. The idea is to examine the meaningful and symbolic content of qualitative data (Lewins, Taylor, & Gibbs, 2005)

Qualitative data analysis involves the identification, examination, and interpretation of patterns and themes in textual data and determines how these patterns and themes help answer the research questions at hand. Qualitative analysis is (Earle, 1997):

- Not guided by universal rules
- Is a very fluid process that is highly dependent on the evaluator and the context of the study
- Likely to change and adapt as the study evolves and the data emerges.

We collected qualitative data to study and analyze from our research questions. In order to analyze the data, we had to recognize our data for the first step. We reviewed our interview text and listened to it several times. We generated valuable qualitative data through this step and transcript them into words.

Secondly, we reviewed our purpose and research questions to identify what we want to find out. According to Taylor-Powell and Renner (2003), we focused the analysis to look at how all individuals responded to each question and topic (Taylor-Powell & Renner, 2003).

Finally, we categorized our data to our certain research questions and searched for what we were benefited from.

#### **3.4.1 Analysing expert interview data**

According to Littig (2003), there are six steps to analyze of expert interviews (see also figure 3.2):

1. Transcription
2. Paraphrasing
3. Headlining
4. Thematic comparison
5. Scientific conceptualization
6. Theoretical generalization

The six steps that Littig suggested could be organized into three parts which the model below shows, data management, descriptive analysis and theoretical generalization.

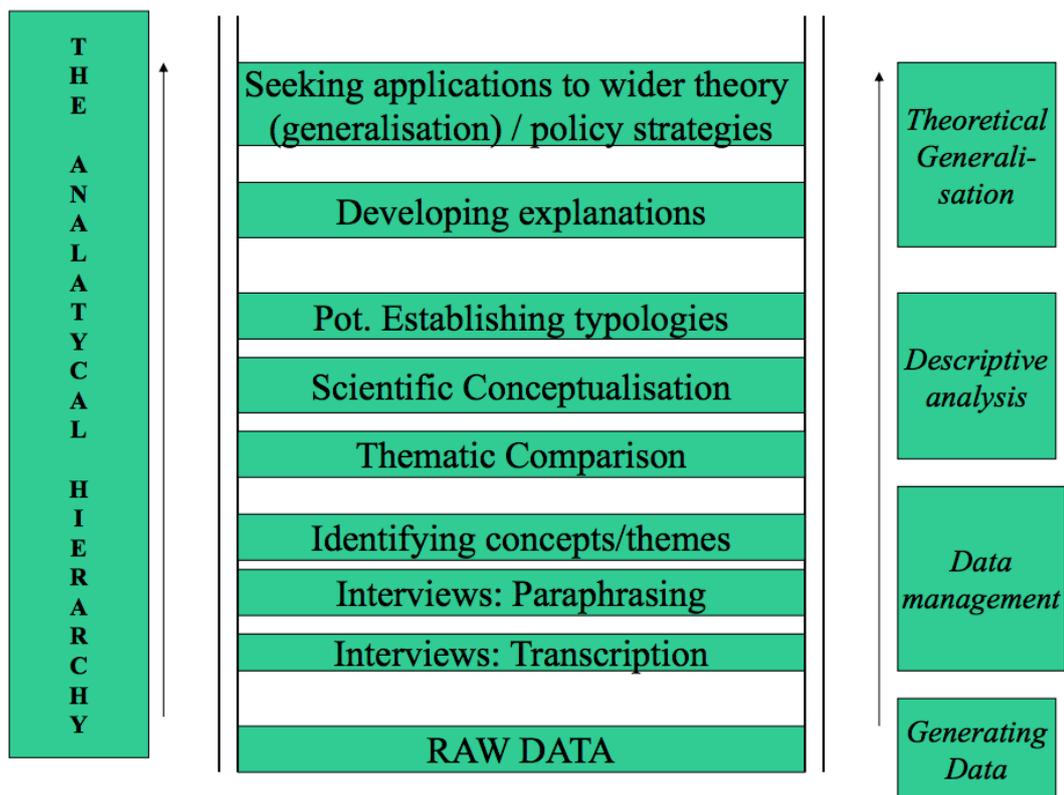


Figure 3.2 Expert interviews analysis

The authors did expert interview analysis followed this model. First, all interviews were transcribed. Then the text was paraphrased and each part of the paraphrased text were given a headline. According to the research questions, six sections were headlined. Under each section, different answers were compared and the one supported our study was picked out. The answers were connected back to the theoretical framework in chapter 2 and defined them with scientific conceptualization. Then, authors started to search the theoretical reference which support our findings from interviews.

### 3.6.2 Qualitative content analysis

Qualitative content analysis, also known as qualitative analysis of content, has been defined as follows: “a research method for the subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes or patterns” (Hsieh & Shannon, 2005), “an approach of empirical, methodological controlled analysis of texts within their context of communication, following content analytic rules and step by step models, without rash quantification” (Mayring, 2000), and “any qualitative data reduction and sense-making effort that takes a volume of qualitative material and attempts to identify core consistencies and meanings” (Patton, 2002).

According to Krippendorff (1980), six questions must be addressed in every content analysis:

1. Which data are analyzed?
2. How are they defined?

3. What is the population from which they are drawn?
4. What is the content relative to which the data are analyzed?
5. What are the boundaries of the analysis?
6. What is the target of the inferences?

A good rule of thumb to follow in the analysis is to use word frequency counts to identify words of potential interest, and then to use a Key Word in Context (KWIC) search to test for the consistency of usage of words (Stemler, 2001). But content analysis was far more beyond just counting words, it also contained categorizing the data. The basics of categorizing can be summed up in these quotes: “*A category is a group of words with similar meaning or connotations*” (Weber, 1990). “*Categories must be mutually exclusive and exhaustive*” (U.S. General Accounting Office, 1996).

Through the transcribed text of interview, authors receive the data not only from the audio but also from the written documents. An advantage of the method is that large volumes of textual data and different textual sources can be dealt with and used in corroborating evidence. Content analysis has been an important way of providing evidence for a phenomenon where the qualitative approach used to be the only way to do this (Elo & Kynga, 2008).

According to Saunders et al. (2009), there is three main types of processes to group data. Authors conducted the one named categorizing data, it involves two activities: developing categories and, subsequently, attaching these categories to meaningful chunks of data. After transcribing the interviews, answers were categorized into different labels according to our theoretical framework and research questions. The categories was guided by our research purpose. After categorizing our data, authors took the information received attaching to each category.

In this study, the purpose of conducting expert interview was to help authors get valid and reliable data that were related to research questions and study area. The interviews were performed through phone calls, Skype and face-to face, in order for future reference, audio was recorded and transcribed into words.

During the analysis session, authors reviewed transcribed documents several time and categorized the collected data, organized a list of key words that had been mentioned in the interviews. After this, the points that related to our research questions and study area were picked out and attached under each category. Both of the authors refined these points individually. After a serious discussion about the refined results, the findings from our expert interviews emerged.

### **3.5 Credibility**

Guba and Lincoln (1981) stated that while all research must have “truth value”, “applicability”, “consistency”, and “neutrality” in order to be considered worthwhile, the nature of knowledge within the rationalistic (or quantitative) paradigm is different from the knowledge in naturalistic (qualitative) paradigm. Consequently, each paradigm requires paradigm-specific criteria for addressing “rigor” (the term most often used in the rationalistic paradigm) or “trustworthiness”, their parallel term for qualitative “rigor”.

### **3.5.1 Reliability**

Joppe (2000) defines reliability as: 'The extent to which results are consistent over time and an accurate representation of the total population under study is referred to as reliability and if the results of a study can be reproduced under a similar methodology, then the research instrument is considered to be reliable.

Before the interviews, authors reviewed our research questions and the theoretical framework. Even though we went through the semi-structured interview, we still organized the question flow which we could follow in our interviews. Interview questions were organized into six categories according to our research questions and differentiated with different experts we were going to interview.

### **3.5.2 Validity**

Content validity refers to the extent to which the measurement device and construct validity refers to the extent to which your measurement questions actually measure the presence of those constructs you intended them to measure (Blumberg et al., 2005).

To achieve high validity in our study, authors applied adequate theories to construct framework for data collection and listed our questions related to our study for the interviews.

## 4 Findings

*In this section of our thesis we present data collected from the interviews.*

### 4.1 Interview findings

After reviewing our interviews, authors categorized our interviews into six sections. Experts in our interviews have at least ten years experience in system and application developing. In Mina VårdKontakter, except the project manager who leads the project, our third-party developers all participate in SDK/API developing and the platform developer are developing applications according to his own idea. For a individual third-party developer, knowledge of SDK/API is important since the guide for it is not clear so far. Besides that, there is still some barriers like no access to the real data, or SDK/API needed has not been released. But, interviewees are still willing to participate in Mina VårdKontakter for the funding from Vinnova. Although, our third-party developers didn't see the opportunities in further developing, the platform developer is still implementing his idea so as to achieve his goal. At the end of each interview, authors discussed the possibility to have a discussion forum for the future. Each one of them showed great interest in it and once there is enough active developers, it could enhance the quality and speed of developing.

#### 4.1.1 Third-party developers contributions to Mina VårdKontakter

Third-party developers contributed to Mina VårdKontakter in several ways. The most common response from our interviewees is that they are contributing by developing new services for Mina VårdKontakter. The services are based on the current structure of the platform, and through the SDK and API Mina VårdKontakter released, third-party developers have the possibility to contribute their own ideas by transforming them into applications.

*"I've been working with a couple of services with MVK and in the web portal. ... It's a tool for life style changes in treatments and rehab. And, there is both, web application for both healthcare ... and patients as well within MVK I also work with another in service, citizens can leave their medical certificates and share them with .... And employers." (Third-party developer A)*

The majority of third party developers contributed in Mina VårdKontakter as freelancers by developing services and applications using the SDK and APIs, but some developers contributed by using the API gateway which was the foundation for this open innovation project.

*"I have been involved in the development project since it started and has together with my colleagues designed and built the software that is named API Gateway. You could say that my primary roles are as an architect, developer and as a technical a project manager." (Third-party developer B)*

The API gateway and SDK, which were first developed, are the foundation of Mina VårdKontakter and they are considered as the main base of the project. All the applications and services of the platform are developed above this base and they are the bricks of the platform that support the whole project. This structure made it easier to adopt the integration of third-party developers into the project and gave them the opportunity to contribute to the platform.

#### 4.1.2 SDK/APIs

Health innovation platform – HIP, is the name of SDK in Mina VårdKontakter. HIP inherited the functions of SDK and some more tools into it. HIP is still under development:

*“The work with the Health Innovation Platform – HIP, which is the new name of the SDK, is still in a project phase and is also a work in progress. We are getting there but some processes must take their time since it is sensitive information we are dealing with.” (Third-party developer B)*

The third-party developers require proper documentation on how to use the SDK and its APIs. This ensures that they understand how to make correct use of the tools provided in their development. If a third-party developer wants to get involved, previous knowledge is required.

*“Regarding the patient bound APIs, which in a sense is more semi-open, we have taken influences from a wide variety of other platforms with commonly used APIs using the same or similar technologies for sharing personal data with a third party, such as Facebook, Twitter, Google, Runkeeper etc. and combined it with a higher level of security” (Third-party developer B)*

The SDK is still under development and more improvements are on the way when these lines were written. According to our interviewee, his development does not require the knowledge of released APIs.

*“The service I’ve been working with for Mina VårdKontakter does not use API gateway.” (Third-party developer C)*

For an experienced third-party developer, the development knowledge needed can be enough in order to implement new applications for the platform using the current documentation of the SDK.

*“I’ve been working with Swedish healthcare with those what the services behind. The API gateway. I know it quite well.” (Third-party developer A)*

According to the interviews, the SDK/APIs released are good tools to start developing for the platform and they are easy to use by experienced developers. But, on the other hand, for developers that lack of knowledge, it is hard to understand and use properly.

*“For me it’s quite easy to get started, cause I.I have previous experience with the service, behind the API gateway. ... for any other developers, this is not used to the healthcare system, they can’t programming contracts, that the stuff like that, I think it’s quite hard to understand. To get start with the platform.” (Third-party developer A)*

And his opinion is supported by our next interviewee, as the SDK needs to be more developed providing better and easy to use tools. Moreover, the documentation and guidelines should be more clearly defined for the less experienced developers.

*“As it is the SDK now needs a lot to be done. It needs a lot of improvement. I think for a developer that it is not so experienced it is not so easy to get involved. I think that it needs a lot of improvement in documentation and provide some better tools and guidelines.” (Third-party developer B)*

According to one of our expert, the strategy that Mina VårdKontakter applying to attract third-party developers is to make API easy to use, thus could attract more developers to take part in this project and make Mina VårdKontakter stronger.

*“The strategies for attracting third party developers is to make it as simple as possible, but not simpler, to be able to use the APIs. ... makes it possible to start testing and work with the APIs in an environment with less security. ... There is also a need to make all necessary developer information easily available through the HIP site and to guide the developer in the right direction.” (Third party developer B)*

Having the knowledge of SDK/APIs and how they could be better use it in one open innovation project, is important during developing. The tools Mina VårdKontakter released are not only the tools for developers to use, but also it could lead into understanding of the whole Mina VårdKontakter platform.

#### **4.1.3 Expectations on and further development of Mina VårdKontakter**

In the beginning of our interviews, we discussed that third party developers must have a lot expectations from Mina VårdKontakter, the experience they would receive, combine their theory to reality or even for the future Swedish National Health’s growing. But after we did the interviews, the situation is not the same. Our interviewees were asked to be a part of the developers which they do not really expect anything from Mina VårdKontakter.

*“I’m not planning on developing any application or apps or something for Mina VårdKontakter. I don’t have any ideas for my own for develops or something like that.” (Third-party developer A)*

According to our interview, the idea of some services and applications are from our interviewee’s client: He is just one developer who implemented those ideas. Even so, our interviewees think that Mina VårdKontakter SDK needs to be improved constantly, so in the future they could deliver better services and applications.

*“My opinion is that in a platform like this there will always be a need of working with constant and iterative improvement.” (Third-party developer C)*

But on the other hand, one of our interviewee who is a single third-party developer will continue his developing which based on his own ideas.

*“Currently I am developing an application for registering documents on the platform. I mean that the EHR can be modified through the platform. I came up with this because this is not possible now. Something exists but it is not much in my perspective. I haven’t finalized by thoughts yet about it. I am still under development. The next idea I have is to improve the booking system. I think now it is not so accurate when someone wants to book a time with a doctor. It seems very general and finally needs a contact through phone with the real personnel on a hospital. I want to make this system automated” (Third-party developer C)*

Third-party developers are willing to participate in this project for some reasons. Some for financial benefits, some others for the experience gained or reputation got from a national project. Even, just have the willing to participant in this project from a patient perspective.

*“First it was the economic interest. I saw it as an opportunity to get involved in a platform that it is widely used. I thought this would result in attracting more clients for new company and it would give me some personal recognition. Also I wanted to add my personal touch to this platform and think as a normal patient would do, like what I need from this platform and what would make my life easier.” (Third-party developer C)*

One other opportunity according to one of the interviewee is, developers create their tools and make their own market. Thus, developers could have financial benefits.

*“The idea is to let the third party developers create their own markets and financial benefits using the tools provided. The Health Innovation Platform is a platform that makes new innovation possible and opens up new markets for third party developers.” (Project manager)*

#### **4.1.4 Barriers for third-party developers**

During our interviews, the word ‘barrier’ has been mentioned frequently. As a third-party developer, it is rare to complete one development in one big project with no barriers. Geography locations, APIs released or even just the developing environment might be a problem. Our interviewees mentioned that third-party developers face problems with the demo-fake data provided and they prefer to have access to real data which will make their development more accurate.

*“As a third party developer you will be able to reach and use data in your applications that has never before been accessible in that way, at least not in Sweden.” (Third-party developer A)*

*“I think as an independent developer, that you don’t have that much experience, it’s almost impossible to get through all the barriers and influences the decision makers in the Swedish healthcare” (Third-party developer B)*

Some barriers cannot be easily conquered, but on the technology level, the SDK/APIs will be developed more and released to developers.

*“From SDK side, it’s not really described. We are working on that to make it more understandable. ... And we also have a small guide. Since some of the decision has not been made, so we can’t publish everything.” (Project manager)*

Developing applications or services is a long process, any single problem could because developers fail to meet the final result and expectations.

*“I think as an independent developer, that you don’t have that much experience, it’s almost impossible to get through all the barriers and influences the decision makers in the Swedish healthcare.” (Third-party developer A)*

Even though the barriers exist there, but to a national project, the people working for it are very helpful for third-party developers to solve their problems.

*“The people from MVK were very helpful and answered to all of my question.” (Third-party developer C)*

Ethical problem can be another barrier in Mina VårdKontakter. Once you decided to have an open innovation project, the ethical issues will occur. The most important one mentioned in our interviews is data protection. Based on our project, Mina VårdKontakter, is an e-health project, some personal information and sensitive data about citizens electronic health record could be revealed by third-party developers.

*“There are of course a lot of considerations regarding handling sensitive data and some of them might be categorized as ethical. For example if your insurance company would give you economic benefits if you open up your personal health data to them. Is that good or bad? ... I must have my own individual freedom to do what I think is for the better with my own information, as long as the information upon my grant to do so has been disclosed to me and no longer is regulated by the patient data laws (Patientdatalagen - PDL).” (Third-party developer B)*

#### **4.1.5 Discussion Forums for Mina VårdKontakter**

Discussion forums have been widely used in open innovation project. They provide several benefits for developers who get involved in that project according to University of Cambridge such as (University of Cambridge, 2014):

1. Learn from experienced practitioners
2. Network and share experiences with other organizations along the Health value chain
3. Benefit from ongoing research
4. Develop insights into OI opportunities in health
5. Establish real spin-off OI collaborations.

##### **4.1.5.1 Discussion Forum for Developers**

As what the authors mentioned above, benefits could be gained by discussion forums where developers could interact with each other. Our interviewees agreed on this opinion.

*“Yes, I think a forum would be very beneficial. It will help in exchange of ideas between the developers and each one can help the other. This can be done like a team work and all we can work for the best.” (Third-party developer B)*

One of the interviewee suggested to use a Q&A section as the start of the forum.

*“I think there some sort of forum, discussion forum or Q&A forum could be a really good idea to get developer start this forum.” (Third-party developer C)*

Meanwhile, some concern has been mentioned in our research, one is the lack of registered developers.

*“Since we are not fully ready, so hard to say something about it. So far there is about 20 developers had been registered.” (Third-party developer B)*

*“But the problem is the guy behind this platform should be really active to answer these questions.” (Platform developer)*

##### **4.1.5.2 Discussion Forum for Patients**

Discussion forums for patients is another idea in health care innovation project. As users, they could report bugs or simply leave their ideas or opinions on the forum, thus developers could follow up in the further developing.

*“Maybe... And, a forum for patients or users to share their ideas might be an interesting idea.” (Third-party developer A)*

*“The patients are the target in this platform. So yes a forum like that is needed.” (Third-party developer B)*

*“Sure, it’s a possibility. ... that can be advertised a Q&A forum.” (Third-party developer B)*

Since the patients are not fully aware the technology as developers, forum for patients and developers should be separated or assigned into two sections.

## 5 Discussion

*In this section we are combining the findings from our interviews with the theoretical framework. The purpose is to investigate if our findings correspond to the theory and to reality.*

### 5.1 Conclusions: Answering the research questions

The findings we got from the interviews lead us to answer our research questions. The final answers are presented here and are based on what we derived from the interviews.

#### 1. What interest do third-party developers have to participate in the development of services in Mina VårdKontakter?

From our interviews, it was clear that the major reason behind the involvement in this project was financial. But, on the other hand, the participation and contribution in this development does not provide any economic benefits for the third-party developers. Therefore, how these two different approaches connect to each other? What we found from our interviews is that the third-party developers are actually hired by companies or have their own companies. In addition, all the interviewees mentioned the project owner and research financier Vinnova and explained to us what this organization represents. So, each company can apply their innovation projects to Vinnova and if it considered promising, it can gain funds which they can be used after to hire the developers. As a consequence, we understand that the interest is not direct by it comes up from who wants to invest to the platform and its future potential. This is also supported by a developer who has his own company and he is contributing for his personal recognition for him and his company. These findings are in strong contrast to the traditional notion of the open-source software developer who is mainly motivated by the sense of belonging to a community and by the opportunity to learning more about software development (von Krogh, 2003). Instead, the third-party developers take on the role of innovation merchants (Chesbrough, 2003), who focus on a narrow set of technologies in order to sell them to a platform owner.

#### 2. What opportunities and challenges do they see after their participation in the project?

The interviewees see their involvement as a chance for economical and personal success. They see the development for this platform as a chance to boost their career and attract more clients for their future development projects. Besides, some of them take into consideration how a patient would think. This can be a source for ideas that leads to new applications, useful for any user of the platform. The challenges they see is how to overcome the limitations the development platform has at the moment. The protection of the data is of crucial matter but the third party developers argue that a small access to EHR would help them to get better understanding and develop more accurate applications. Furthermore, the documentation provided is facing lack of information for developers. If a third party developer wants to get involved with the platform needs to have a good knowledge and experience. This can be provided by adding guidelines and documentation as a complement to the SDK/API (Yoo et al., 2010). Otherwise it is considered hard for a less experienced developers to participate. In the terminology of Chesbrough (2003), the project organization of Mina VårdKontakter has the role of an innovation architect, providing an architecture for third-party developers to contribute with smaller pieces to a complex system: *“To be successful innovation architects must establish their system solution, communicate it, persuade others to support it and develop in the future.”* (Chesbrough, 2003, p. 39).

### **3. What can be improved from the view of a third-party developer regarding software development kit?**

We got a lot of common answers on the current state of the SDK. All the developers agreed that the SDK has a lot of steps to do forward. The documentation and the APIs provided are not enough for development and they are considered as general guidelines. The truth is that the SDK, when these lines were written down, is still under development. The development team of the SDK is currently working on improving the current system, under the name of Health Innovation Platform, by providing more tools and documentation with purpose to enhance the development experience. The third-party developers, also, want to have some access to real data. The current status of the platform does not allow any access to EHRs. This is considered as a problem for the developers as they do not know if their applications are compatible with the patients' data. This is an issue that it is of higher responsibility and only higher governmental officials have the possibility to give access, as matters of secrecy and ethics occur in this situation. Finally, the proposal for discussion forums sounds as a very good practice for an open innovation project like this. The exchange of ideas between the developers and patients would be beneficial for the platform as new applications could be created faster and corresponding to users' needs. From these findings, a conclusion can be drawn that the platform boundary resources provided by the platform owner (Yoo et al., 2012; Ghazawneh, 2012) are still not enough developed to provide adequate support to the third party developers. The technological boundary resources, such as the SDK is still immature, and social boundary resources seem to be lacking entirely.

## **5.2 Integrating third-party developers in MinaVårdkontakter**

As the step to open innovation is currently new for Mina VårdKontakter, the strategy to attract more developers is not totally defined. This is understandable if we take into consideration that SDK is still under development and it is not fully completed. Thus, the effort to attract more developers is considered a hard procedure to accomplish as not all the proper tools are provided. Currently, there is no any real strategy behind this effort but all the views are now on providing a completed tool that it will be a ready solution for any developer. The marketing strategy will come after that step when the platform developers confirm that the SDK is a practical tool that can be used from any developer.

Besides, only individual developers can register to the platform and not companies. This makes difficult to attract developers as there are no financial benefits or any other benefits for those who want to get involved with the project. Meanwhile, the developers that have already registered to the platform, are mostly hired by companies which apply for funds in VINNOVA. Thus, the developers see economic reasons behind their involvement to the platform or personal recognition by providing work that can attract more clients for their other projects.

## **5.3 Goals of E-health in Sweden and third-party applications**

The goals of e-health in Sweden are described in section 2.1.4 is what the Ministry of health wants to achieve in the following years. The step to open innovation is a part of this goal as it will speed up the procedures and reach the desired result faster. The third-party developers seems that are not fully aware of this strategy. The application developed by them are ideas that come from their own perspective on how the platform could be improved and how this could provide a better user experience for the patients. In other words, everything

is created by what the developers think that is missing. There are no specified guidelines on what the Mina VårdKontakter platform wants to achieve or what is needed. There is only a general discussion that until 2018 the platform must be accessible and used by the majority of population living in Swedish territory. Therefore, the opening to the external developers is another piece of the puzzle to reach that goal. The bringing of ideas outside the internal development circle, can make this target to come faster, better and with savings in valuable funds that can be used for other development procedures.

## **5.4 Opportunities for the third party-developers**

The third-party developers see that opportunity Mina VårdKontakter gives as a chance to make another step in their careers. The most interest is derived from the need for financial benefits and personal recognition. As we mentioned before, the majority of the developers registered to the development are freelancers hired by companies that want to invest to the platform. This is an opportunity given to the developers to integrate and they can also provide their own ideas if they want to. Besides, this could be a good opportunity for recognition from other clients which can hire them to develop applications for them.

## **5.5 Barriers and knowledge needed to overcome them**

A project under development is always hard to understand by a third person. The views of our interviewees so that clearly. The current status of the SDK is not suitable for a developer lacking development experience. The documentation, the guidelines and the APIs are not explained thoroughly. Thus, only experts on the field on development can understand its structure and how it can be used. This is the most common barrier a developer face with the Mina VårdKontakter SDK. As a consequence, a developer that wants to develop for the platform must have a good knowledge otherwise it is difficult or impossible to develop an application for the platform

In addition to this, developers mentioned and the high complexity of the platform. Its structure it is considered complicated and hard to understand even from an experienced developer. Moreover, the integration process of an application is considered rather long. The authorization process has a top-down approach, where the application needs to pass from many authorities and gain the proper permission before the integration. This is considered as time consuming from third-party developers view.

### **5.5.1 Improvements on the SDK**

Platform boundary resources provided by platform owners are means to facilitate use of the platform's functionalities and design of new applications. It was evident from the interviews that the provided boundary resource, the SDK was not developed enough. In the last part of our discussion with the interviewees we discussed what improvements could be done to the SDK in order to be more functional and easier to use.

#### *Documentation*

The current documentation lacks useful and valuable information that will help the developers in the creation of their applications. The third-party developers from their perspective propose a better and richer documentation that will make their development experience easier. Besides, having a good documentation, could attract more third-party developers to declare interest and engage in the platform development.

#### *Access to Data*

The need for accurate data is crucial. It is understandable that access to real data is always difficult or impossible to achieve. In our situation, matters of secrecy and ethics occur and as a consequence it is a discussion that it cannot be done among developers but it is under the authority of governmental officials.

#### *Runnable Examples*

A good practice in open innovation projects is to provide runnable examples to the third-party developers. This helps the externals to get a better view of how the platform functions and integrate these to their own applications. Besides, this can help to development of applications in the meaning of being bug-free and fully functional.

#### *Discussion Forums*

The developers from both sides, third-party and platform developers, found the idea of discussion forums interesting and promising. A discussion forum can be used on problem solving and exchange of ideas among developers. Furthermore, a different forum could be created where the patients can write their own experiences for the platform, propose new ideas and report bugs. It could be in other words a pool where developers can keep in touch with what is needed and what needs to be improved.

## **5.6 Results discussion**

The purpose of this thesis was to investigate the involvement of third-party developers in Mina VårdKontakter. Through our interviews with people involved with the platform, as internals or externals, we got a clear understanding of the current state of SDK.

The findings of our research can contribute on how Mina VårdKontakter can attract more third-party developers. We observed during the research that the interest from the external developers is currently very low. This seems logical if we take into consideration the current state of the SDK. In the beginning of our research we tried to find third party developers around Sweden that may have interest in engaging with the platform. The impressions we had were anything else but promising as none was aware of the SDK or even Mina VårdKontakter. The results we collected through our interviews, revealed that the reason is that SDK is still under development face and a lot of improvement needs to be done. We also observed that interest hides behind deeper economic reasons even though the contribution to the platform does not provide directly any financial benefits to the third party developers. Furthermore, the third-party developers that have already registered to the platform gave us their views of the platform and according to their opinion the SDK is not fully developed and it needs further improvement of documentation and guidelines.

The research findings support the theories that in an open innovation project you must provide the right tools. The tools provided right now, from one side they fulfil their purpose but from the other side they are not enough. We can say that it is a effective start but it is time for the platform to do the next step needed. This step is to provide a full support tool for third party developers with proper documentation and guidelines. In regard to their real data, as we have mentioned before it is on hands of higher officials and we cannot provide them directly as matters of secrecy and privacy always occur.

## **5.7 Methods discussion**

In this research, authors followed qualitative methodology to develop further follow-up study. The response gained from expert interviewees, along with the theoretical under-

standing, have been used to get deeper understanding of third-party developers' perspective in Mina VårdKontakter. This study is conducted with an objective point of view.

The authors conducted expert interviews with semi-structured structure. It is also the primary data collection method for our research. Generally, the findings are refined from the words that experts expressed. This is the only method that authors used to collect primary data which could be seen as the limitation in our study. Using another method like case study at the same time might be a better way to collect data and have an even deeper understanding of our study. We could also have the detailed information about third-party developers' perspective and feelings during developing as well.

There are certain barriers authors had to conquer in order to achieve high reliability and validity. The interviewees were carefully selected to achieve the purpose of this study. In order to generate the data related to this thesis, theoretical framework was strictly followed during building up the interview guide and structure. So the feedback could be understood and trustable. Each expert has different opinions on the same question, to eliminate the misunderstanding from the feedback, authors reviewed the interview structure and design the interview question fully according to our research question.

Another part that should be mentioned is that in our expert interviews, the number of third-party developer was low due to the reason that Mina VårdKontakter is in the beginning phase and the SDK/API should be done by professionals. As Mina VårdKontakter matures, more third-party developers will be involved voluntarily. Due to time limitations, the authors could not take part in the development of Mina VårdKontakter. But with the enough programming background, an action research methodology could be applied in further research.

Finally, in this study, the most mentioned word is third-party developer. The research could also concern the point of view of managers, decision makers, and their opinion about third-party developers giving the study a new, complementary perspective of third-party development.

## **5.8 Implication for research**

This study contributes to literature about third-party development. It combines third-party development with open innovation health care project, focusing on not just open innovation projects itself, as most previous studies. This study provides a different perspective inside the open innovation project which from a third-party developers' view. Additionally, this study reveals the connection between third-party developers and open innovation health care project platform owners.

## **5.9 Implication for practice**

The findings of this study are orientated towards third-party developers in Mina VårdKontakter in Sweden. It also concentrates on practical aspects of how Mina VårdKontakter could attract more third-party developers getting involved. The study showed that most third-party developers are interested in the funds that Vinnova could provide so far. The decision makers of Mina VårdKontakter should take more consideration in their next step about open innovation after the SDK/API gets more mature. Thus, third-party developers will have a clear guide to lead themselves into the further developing. The SDK/API is a technological platform boundary resources. Third-party developers will also need social platform boundary resources (Ghazawneh, 2012), such as clear incentives, and agreements of property rights with the platform owner. This implication is also supported by West

(2005), who stated that companies should have special agreements with individuals wanting to contribute to product development by open innovation.

## **5.10 Further research**

This study shows the thoughts and opinions from the third-party developers' point of view. There are some limitations.

### *Data protection*

In our interviews, interviewees have all mentioned that it is difficult to access the real data for developing. Based on the patient data law in Sweden, further research could devote themselves in data protection from third-party developers.

### *Widen the third-party developers pool*

In the future research, more third-party developers could be involved in the interviews which could generate more opinions towards their developing in Mina VårdKontakter.

### *Discussion Forums*

With the mature of Mina VårdKontakter, more third-party developers will be involved in this project. The community of developers will be more active. According to our interviews, all our interviewees had interests in the discussion forum. The future possibility of constructing a forum could be one further suggestion.

### *Patients' point of view*

Another suggestion for the further research is from a patient's perspective. As the user of Mina VårdKontakter, their opinion of the platform should be taken into consideration.

Our thesis explored the challenges and opportunities third-party developers face by their involvement in the development of Mina VårdKontakter. We suggest that further research on the subject can be performed when a satisfying number of third-party developers are registered to the platform. Furthermore, we suggest that the research could be done from a wider perspective of the developer community. By this we mean that the data collection can be done from third-party developers that are not registered in the platform but are aware of it and have declared interest to get involved in the future. Additionally, we would suggest the investigation of other open innovation projects around the world in the field of e-health.

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## Appendix

### Appendix A

Questions for the third party developers

1. Could you tell us a little about your background in development?
2. How did you come in contact with Mina VårdKontakter and the possibility to develop services for the Swedish healthcare?
3. Have you contributed to the Swedish healthcare through other services before?
4. Why did you engage in this platform? What are your expectations?
5. Do you think that there are any barriers that prevent others from contributing?
6. In what way are you developing for the platform?
  - a. What type of service are you developing/planning to develop?
  - b. How did you come up with the idea on what to develop?
  - c. Is your ideas for development compatible with the goals specified by the e-health strategy in Sweden?
7. How has the development for the platform influenced your primary work?
8. Have you encountered any challenges connected to your development at the platform?
  - a. Does the SDK provide you with useful tools?
  - b. Is your knowledge suitable enough to develop a module for this platform?
  - c. Would you like to expand the tools in any way? How could the owners of the platform improve the SDKs?
9. What are the opportunities of contributing to the platform?
10. Do you think that the organization behind Mina VårdKontakter should provide financial benefits for the third-party developers?
11. In your opinion, does Mina VårdKontakter needs to create an online community where developers and patients can communicate and exchange ideas (like a discussion forum)?
12. Is there anything else you would like to add?

## Appendix B

Questions for platform developers:

1. Could you tell as a little about your involvement to the platform? What is your primary role?
2. Why did you decided to apply open innovation to Mina VårdKontakter?
3. In the design of the SDK have you used any previous knowledge from other open innovation projects?
4. Do you think that SDK is a completed tool for a developer? Does it need further improvement?
5. What is your strategy in order to attract more third party developers? Do you provide any financial benefits to the developers? Why do you think that the developers would be interested to contribute to the platform?
6. Are there any ethical issues behind the secrecy of data? A third party developer will be able to access Electronic Health Records or any other crucial information?
7. What is the procedure for a module to integrate in the platform? Is this module electronically signed by the third party developer or it belongs to the community (stays under anonymity)?
8. Does the interest from third party developers, which you have until now, satisfy your expectations?
9. In your opinion, could Mina VårdKontakter benefit from to create an online community where developers and patients can communicate and exchange ideas (like a discussion forum)? How could MVK benefit from a community?
10. Have you planned the next step for the platform in the area of open innovation?
11. Is there anything else you would like to add?