An Analysis of the Transferability of E-Health Solutions

A thesis submitted in fulfillment of the requirements for the degree of

Doctor of Philosophy

Manuel Zwicker

Diploma in Business Information Systems, MBA

School of Business IT and Logistics

College of Business

RMIT University

February 2014

Declaration

I certify that except where due acknowledgement has been made, the work is that of the author alone; the work has not been submitted previously, in whole or in part, to qualify for any other academic award; the content of the thesis is the result of work which has been carried out since the official commencement date of the approved research program; any editorial work, paid or unpaid, carried out by a third party is acknowledged; and, ethics procedures and guidelines have been followed.

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Date   Signature Manuel Zwicker

Acknowledgments

Firstly and foremost, I want to deeply thank my senior supervisor Professor Nilmini Wickramasinghe for her always excellent support and advice during the last years. Your outstanding feedback and our in depth discussions over the last years, even on the weekend, were very helpful for writing up this dissertation. It was a wonderful time and I really appreciate our collaboration and our publications, which resulted over the last years.

I also want to thank my second supervisors Dr. Say Yen Teoh and Dr. Hossein S. Zadeh for their great support and also their valuable suggestions over the years. Your feedback and ideas helped me a lot and lead to a richer research.

In addition, I want to thank my German mentor Professor Juergen Seitz (Duale Hochschule Baden-Wuerttemberg Heidenheim – Baden-Wuerttemberg Cooperative State University Heidenheim, Germany) for his great advice and support over the last years. He always listened to me and he always found the right words at the right time.

Furthermore, I would like to thank all academics including PhD students, medical practitioners and conference participants, who helped me at different stages of this thesis with their comments, feedback, suggestions and discussions. I want to point out here especially Bill Davey (RMIT University, Melbourne, Australia), Professor Richard de Steiger (Epworth HealthCare, Melbourne, Australia) and Dr. Jonathan Schaffer (Cleveland Clinic, Cleveland, U.S.).

Additionally, I want to thank all interview participants, because their feedback was fundamental for the outcome of this dissertation. All of them spent a lot of their time with me for conducting the interviews and I really appreciate this effort.

Finally, I want to thank my whole family and friends for their well wishes, encouragements and supports over the last years. Special thanks also to my beloved girlfriend Sarina Ferkau for her sympathy and support over the years, even if I were for several months abroad in Australia.

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Abstract

Countries like the member states of the Organization for Economic Cooperation and Development (OECD) are confronted with several challenges: technological changes, longer life expectancy, population aging and rising health expenditure. The resulting cost pressure forces these countries to change their healthcare systems. As the usage of ICTs especially in e-health solutions is the answer, countries are developing their own national e-health solutions. However, two significant problems arise: firstly, these national e-health solutions are platform centric, meaning that they are suboptimal and not in line with the doctrine of network centric healthcare; secondly, an own development is very costly and time consuming. Consequently, the research question "How can different e-health solutions be transferred to other countries?" is investigated.

The methodology used for this exploratory study is based on a mixed research approach. Thereby, an exemplar case study in Australia and an exemplar case study in Germany are conducted. The case study in Australia and the case study in Germany involve unstructured interviews with e-health stakeholders and a questionnaire based on closed-ended questions for the general public. Further, in both countries, an ethnographic study was conducted at a hospital. In Australia, the chosen hospital was a private hospital. In Germany, the selected hospital was a public hospital, where the mission statement is oriented on the Christian anthropology.

Thematic analysis is used for analysis of the interview data. The three a priori themes are key factors, barriers and facilitators. The key results of the interviews are presented for each focus (i.e. national, transfer, global) in a separate table. Within each table, the findings are separated for each country and are assigned to the a priori themes as expected findings or emerging findings. Further, the emerging themes are identified and outlined for each focus, which are: "special cases" (national), "environment" (transfer) and "knowledge/exemplars" (global). Moreover, based on all key findings, the significant findings, such as laws, healthcare systems, culture and medical standards could be identified.

The questionnaire results show that only a few participants are informed about the e-health solution of their country. Furthermore, it is stated that 46 % of the 52 informed participants think that the transferability of e-health solutions across countries is possible. In addition, there is overall no clear tendency visible that a global e-health solution is seen to be possible in the future. Moreover, it is presented that informed participants, who think that the

transferability of e-health solutions across countries is possible, also have a very high tendency to believe on a global e-health solution in the future and the other way around.

The results of the ethnographic study show that there exist similarities and differences in the context of hip and knee surgeries among the chosen hospitals in Australia and Germany. Further, it is mentioned that e-health solutions on a single stakeholder and national level are suboptimal, if they only address internal issues and are not being designed with a network centric perspective. Therefore, it is stated that the transfer of one suitable national e-health solution to other countries is one way, how countries can implement a national e-health solution with a global/network centric perspective, which is in this way likewise beneficial for the single stakeholders, if they consider and integrate the national e-health solutions into their own e-health solutions and further into their processes, technologies and people.

Based on these findings, the discussion is performed. In this way, also the triangulation of the findings is conducted. At the end, the research question and its three sub-questions are answered.

CHAPTER 1

1.   Introduction

Firstly, this chapter states the research problem. Secondly, essential definitions for this study are presented, followed by the research question and objectives. Thirdly, the importance of this research is highlighted. Finally, the outline of this thesis is presented.

1.1   Statement of the Problem

Over the last 40 years of the previous millennium and now the current millennium, the healthcare industry is the focus of many countries (OECD 2011a). Countries like the 34 member states of the Organization for Economic Cooperation and Development (OECD), which are Australia, Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom and United States, are confronted with serious challenges, when they focus on healthcare (OECD 2012a). These challenges include technological changes, longer life expectancy, population aging as well as steadily rising health expenditure (OECD 2011a).

Technological changes comprise the development, implementation and improvement of technologies like e.g. computed tomography (CT) and magnetic resonance imaging (MRI) (OECD 2011a). Regarding life expectancy, within the OECD countries life expectancy had increased on average by more than 11 years from 1960 to 2009 leading to an average of almost 80 years in 2009 (OECD 2011a). In other words, while in 2000 a total life expectancy of 80 years or more counted for two OECD countries, in 2009 already 22 OECD countries had achieved this number (OECD 2011a).

Figure 1 gives for the OECD countries an overview of life expectancy at birth based on 2009 and years gained since 1960. Based on these numbers it can be seen that for all OECD countries longer life expectancy is an important issue to be considered. For all these countries life expectancy had clearly been raised from 1960 to 2009. That means that Korea with the highest growth had an increase of 27.9 years, while the Slovak Republic with the lowest growth had an increase of 4.4 years. Figure 1 also shows that Japan had with 83 years the highest life expectancy at birth in 2009, while Turkey had with 73.8 years the lowest life expectancy at birth in 2009 (OECD 2011a).

In the future, it can be expected that life expectancy will heavily increase in countries located at the lower end (e.g. Turkey, Hungary, etc.) due to the fact that Turkey had with 25.5 years one of the highest gains in life expectancy from 1960 to 2009.
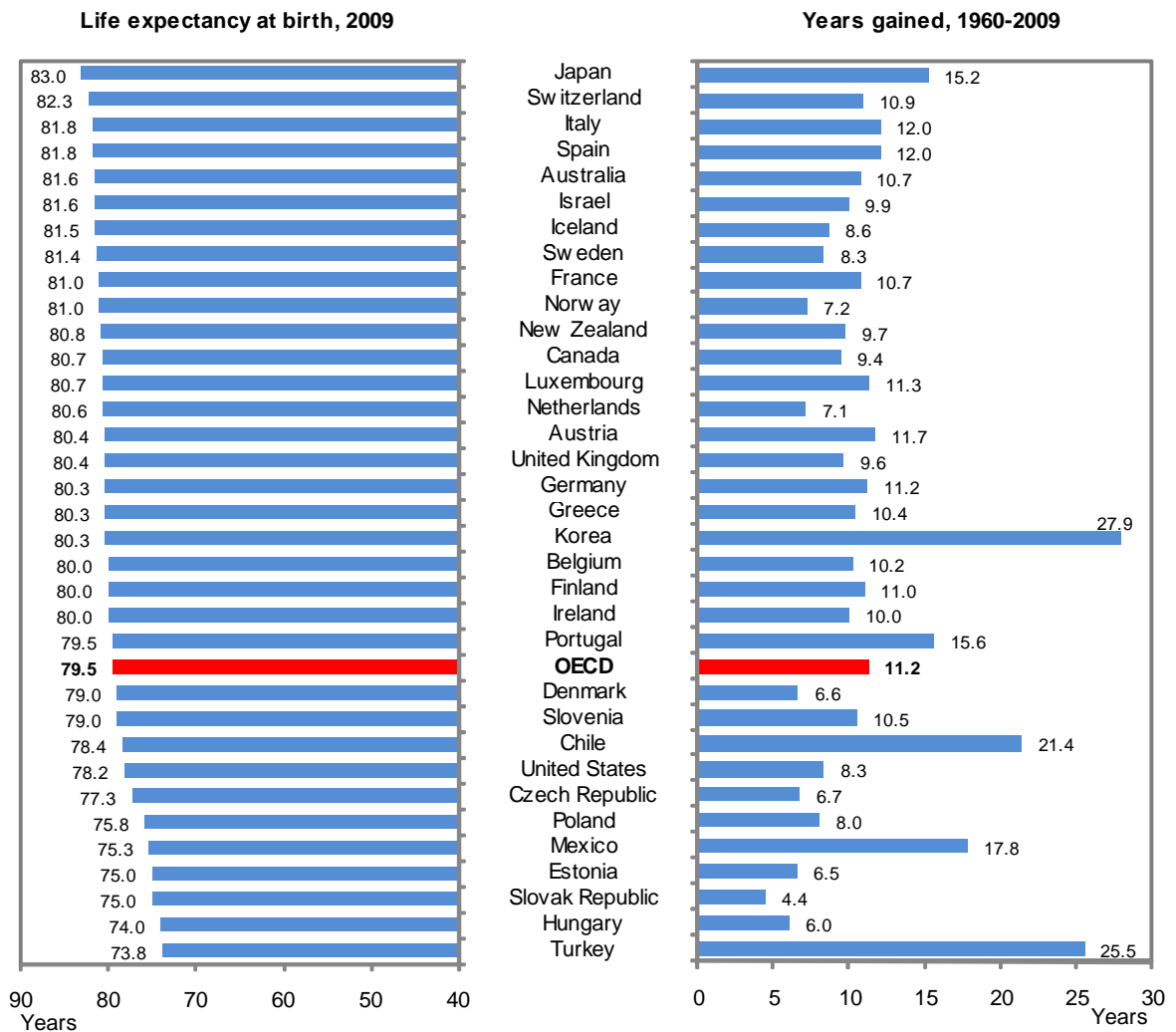
Figure 1: Life expectancy at birth; years gained since 1960 (adapted from OECD 2011a; OECD 2011b)
[These data are based on the last published data from 2009 (or nearest year available): Italy 1961 – 2008; New Zealand 1961 – 2009; Canada 1961 – 2007.]

Additionally to technological changes and the fact that life expectancy is increasing over the last decades, countries have also to deal with an aging population (OECD 2011a). The following table 1 shows the share of population aged 65 or more for different OECD countries. Furthermore, it presents how this indicator had changed from 1960 to 2009. Based on these numbers, the OECD average share of population aged 65+ had dramatically increased from around 8.5 % in 1960 to about 14.9 % in 2009 (OECD 2011a).

	1960	1970	1980	1990	2000	2009
Australia	8.5	8.3	9.6	11.1	12.4	13.3
Austria	12.2	14.1	15.4	14.9	15.4	17.5
Belgium	12.0	13.4	14.3	14.9	16.8	17.1
Canada	7.5	7.9	9.4	11.3	12.6	13.9
Chile	4.8	5.0	5.5	6.1	7.2	8.8
Czech Republic	9.6	12.1	13.5	12.5	13.8	15.0
Denmark	10.6	12.3	14.4	15.6	14.8	16.1
Estonia	10.5	11.7	12.5	11.6	15.1	17.0
Finland	7.3	9.2	12.0	13.4	14.9	16.9
France	11.6	12.9	13.9	14.0	16.1	16.7
Germany	10.8	13.2	15.5	15.3	16.4	20.5
Greece	8.1	11.1	13.1	13.8	16.6	18.8
Hungary	9.0	11.6	13.4	13.3	15.1	16.5
Iceland	8.1	8.8	9.9	10.6	11.6	11.8
Ireland	11.1	11.1	10.7	11.4	11.2	11.1
Israel	5.0	6.7	8.6	9.1	9.8	9.8
Italy	9.3	10.9	13.1	14.9	18.3	20.4
Japan	5.7	7.1	9.1	12.1	17.4	22.7
Korea	2.9	3.1	3.8	5.1	7.2	10.7
Luxembourg	10.8	12.5	13.6	13.4	14.1	14.0
Mexico	3.4	4.6	4.3	4.1	4.7	5.8
Netherlands	9.0	10.2	11.5	12.8	13.6	15.2
New Zealand	8.7	8.4	9.7	11.2	11.8	12.8
Norway	11.0	12.9	14.8	16.3	15.2	14.8
Poland	5.8	8.2	10.1	10.1	12.2	13.5
Portugal	7.9	9.4	11.3	13.4	16.2	17.8
Slovak Republic	6.9	9.2	10.5	10.3	11.4	12.2
Slovenia	7.8	9.9	11.4	11.1	14.0	16.2
Spain	8.2	9.6	11.2	13.6	16.8	16.7
Sweden	11.8	13.7	16.3	17.8	17.3	17.9
Switzerland	10.2	11.4	13.8	14.6	15.3	17.2
Turkey	3.6	4.4	4.7	4.4	5.4	7.6
United Kingdom	11.7	13.0	15.0	15.7	15.8	15.8
United States	9.2	9.8	11.3	12.5	12.4	13.0
OECD	**8.5**	**9.9**	**11.4**	**12.1**	**13.5**	**14.9**

Table 1: Share of population aged 65 and over, 1960 – 2009 (adapted from OECD 2011a; OECD 2011c)

Looking into a forecast of the World Health Organization (WHO), it is expected that from 2000 to 2050 the percentage of the worldwide population over 60 years will rise from approximately 11 % to 22 % (WHO 2012a). In absolute figures it is estimated that the total amount of people aged 60+ will rise from around 605 million to 2 billion people in the same timeframe (WHO 2012a).

Due to technological changes, longer life expectancy and population aging, countries have additionally to fight against rising health expenditure (OECD 2011a). While in 1960 the

average total health expenditure across OECD countries was less than 4 % of Gross domestic product (GDP), in 2009 this indicator accounted for 9.6 % of GDP (OECD 2011a). Thereby, total health expenditure includes the current health expenditure and the capital investments in healthcare infrastructure (OECD 2011a). Total health expenditure and health expenditure are used as synonyms in this thesis.

To illustrate this serious problem, figure 2 shows the trend of rising health expenditure for several OECD countries between 1975 and 2008. It is important to note that in numerous countries that the health expenditure as a share of GDP had tended to increase a lot during times of economic recession and tended to stabilize or decline during times of economic expansion (OECD 2011a). However, GDP is not the only indicator, which affects the amount of health expenditure as a share of GDP (OECD 2011a). Developments in health expenditure in relation to GDP are the consequence of the joint effect of developments in GDP as well as health expenditure (OECD 2011a).
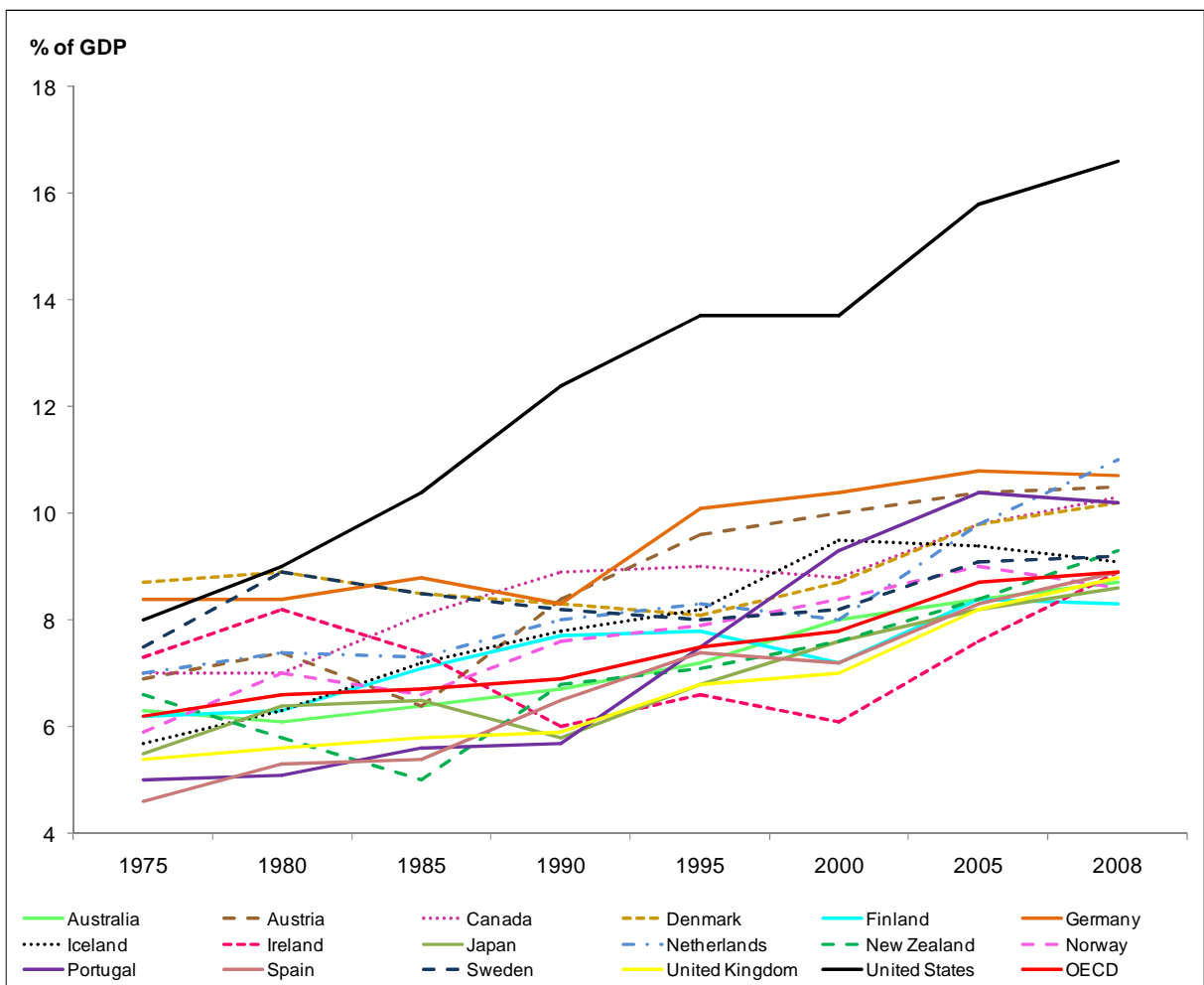
Figure 2: Trend of total health expenditure as a share of GDP, 1975 – 2008 (adapted from OECD 2012b)
[The red line shows the average ratio of health spending as a share of GDP within the OECD countries.]

Figure 2 highlights that since the eighties the United States has by far the highest health expenditure compared to all presented OECD countries. There is a tremendous range along OECD countries regarding their health expenditure as a share of GDP as well as their health spending growth rate (OECD 2011a; OECD 2012b).

Looking back to 2009, the OECD average health expenditure was US$ 3,233 (PPP) per capita and 9.6 % of GDP (OECD 2011a; OECD 2011e). This represented a strong rise compared to 8.8 % of GDP in 2008 (OECD 2011a). Though, the global recession had already affected several countries in 2008 and therefore these countries were heavily impacted (OECD 2011a).

In order to compare the health expenditure in absolute figures across OECD countries, all budgets have been converted to US$ (OECD 2011a). Furthermore, the method of PPP (Purchasing Power Parity) was applied in order to exclude differences in the purchasing power of national currencies (OECD 2011a).

Figure 3 illustrates the total health expenditure as a share of GDP in 2009 for several countries. The total health expenditure is split into public and private health expenditure.
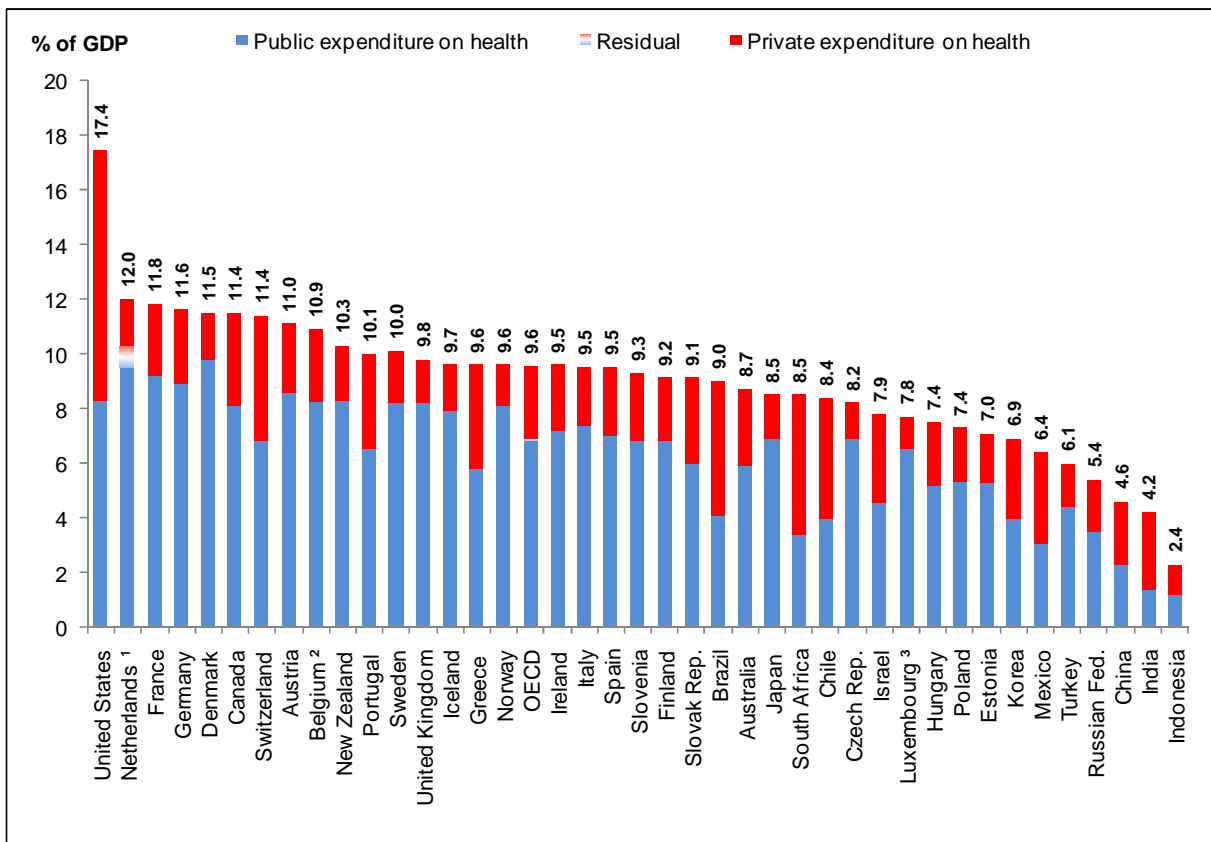
Figure 3: Total health expenditure as a share of GDP, 2009 (adapted from OECD 2011a; OECD 2011d)
[These data are based on the last published data from 2009 (or nearest year available): Greece 2007; Portugal 2008; Australia 2008; Japan 2008; Turkey 2008. 1. In the Netherlands, it is not possible to clearly distinguish the public and private share related to investments. 2. Total expenditure excluding investments. 3. Health expenditure is for the insured population rather than the resident population.]

Figure 4 shows the total health expenditure per capita in US$ (PPP) in 2009 for several countries. However, the total health expenditure is split into public and private health expenditure.
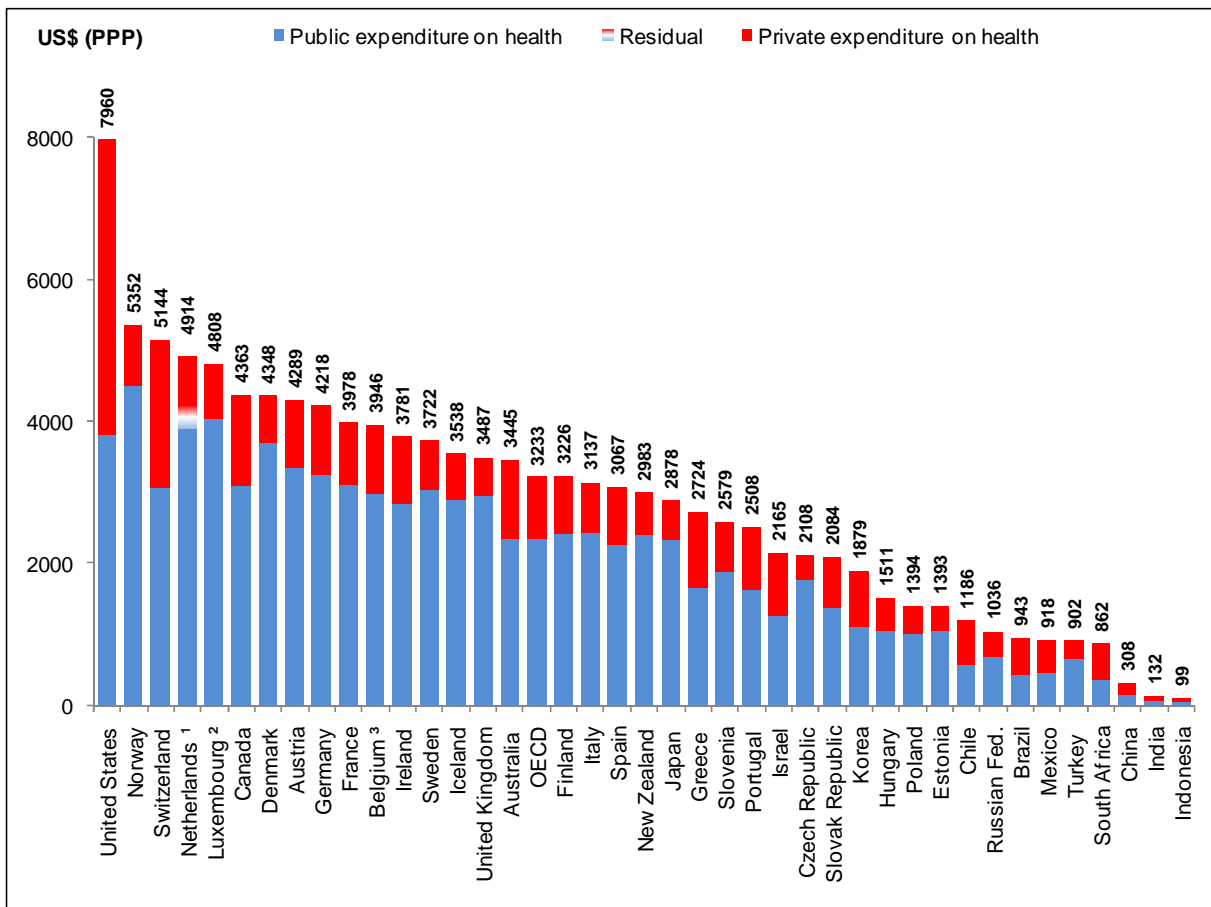
Figure 4: Total health expenditure per capita 2009 (adapted from OECD 2011a; OECD 2011e)
[These data are based on the last published data from 2009 (or nearest year available): Greece 2007; Australia 2008; Japan 2008; Portugal 2008; Turkey 2008. 1. In the Netherlands, it is not possible to clearly distinguish the public and private share related to investments. 2. Health expenditure is for the insured population rather than the resident population. 3. Total expenditure excluding investments.]

Both graphs (figure 3 and figure 4) show that the United States is by far the clear leader of health expenditure across all OECD countries and countries like for example China, India and Indonesia (OECD 2011d; OECD 2011e).

Because of these challenges, i.e. technological changes, longer life expectancy, population aging and rising health expenditure, countries are confronted with a tremendous cost pressure. Therefore, there is a focus to cut back healthcare budgets and offer effective and efficient quality of care (Wickramasinghe et al. 2005; Wickramasinghe and Schaffer 2010). Generally, automation and technologies have the capability to reduce costs and to increase quality of healthcare (Wickramasinghe and Goldberg 2004; Wickramasinghe and Misra 2004; Wickramasinghe et al. 2005; Wickramasinghe and Goldberg 2007; Abd Ghani et al. 2010).

However, the usage of information and communication technologies (ICTs) especially in e-health solutions is the answer to reacting to these challenges and needs (Wickramasinghe et al. 2005; Wickramasinghe and Schaffer 2010).

New healthcare reforms are essential to address the current challenges. Therefore, countries like Australia, Germany, U.K., U.S. and other OECD countries are changing their healthcare systems. They have realized that with the usage of ICTs particularly in e-health solutions, costs of healthcare can be decreased, while on the other hand the healthcare quality can be enhanced (Wickramasinghe et al. 2005; Wickramasinghe and Schaffer 2010). This implies that e-health becomes more and more a vital component of healthcare delivery these days, because under the usage of e-health, healthcare stakeholders are closer connected and health information exchange can be realized in a faster and more efficient manner (Wickramasinghe et al. 2005; Wickramasinghe and Schaffer 2010).

However, while they develop national e-health solutions, it seems that these countries concentrate efforts to address internal issues and therefore these e-health solutions are platform centric in nature (von Lubitz and Wickramasinghe 2006). In this way, these e-health solutions are not being designed with a global/network centric perspective (von Lubitz and Wickramasinghe 2006). This is a problem, because platform centric national e-health solutions are suboptimal, i.e. they can prohibit or limit cooperation across different national e-health solutions and health information exchange across different healthcare players globally (von Lubitz and Wickramasinghe 2006). Therefore, they can lead to a lower health information quality and integrity and consequently inappropriate or low quality treatments for patients globally (von Lubitz and Wickramasinghe 2006). For that reason, countries presumably deteriorate the actual situation, because they develop more expensive, poor quality solutions (von Lubitz and Wickramasinghe 2006). Though, because healthcare delivery is a worldwide phenomenon and global operations are widespread, it is important for e-health to have a global network structure (Wickramasinghe et al. 2007; Wickramasinghe and Schaffer 2010). This supports unhindered healthcare operations including information sharing across different countries (Wickramasinghe et al. 2007; Wickramasinghe and Schaffer 2010). Both of these are the central aspects behind the network centric perspective and the doctrine of network centric healthcare (Wickramasinghe et al. 2007; Wickramasinghe and Schaffer 2010).

Another problem is that countries are currently developing their own national e-health solutions. This is a problem, because as several examples show, an own development is very

costly and very time consuming. This problem is closer exemplified on the Australian national e-health solution (section 2.2.3) and the German national e-health solution (section 2.2.4) as well as the comparison/contrast of them (section 2.2.5).

One way to implement a national e-health solution with a global/network centric perspective and to avoid the risks of an own development is to transfer one suitable national e-health solution to other countries. As a result, it should be feasible to exchange health information among these countries, while costs can be reduced and quality of care can be increased.

In order to summarize the research problem, the following figure 5 is presented. As this figure shows, countries like the OECD countries are confronted with several challenges: technological changes, longer life expectancy, population aging and rising health expenditure. The resulting cost pressure forces these countries to change their healthcare systems. As the usage of ICTs especially in e-health solutions is the answer, countries are developing their own national e-health solutions.

Challenges
- **Technological changes**
- **Longer life expectancy**
- **Population aging**
- **Rising health expenditure**

Consequences
- **Tremendous cost pressure for several countries**
  ➥ **They are changing their healthcare systems**
      ➥ **Development and implementation of national e-health solutions**

Problems
- **National e-health solutions are platform centric, i.e. they are suboptimal**
- **Own development is very costly and time consuming**
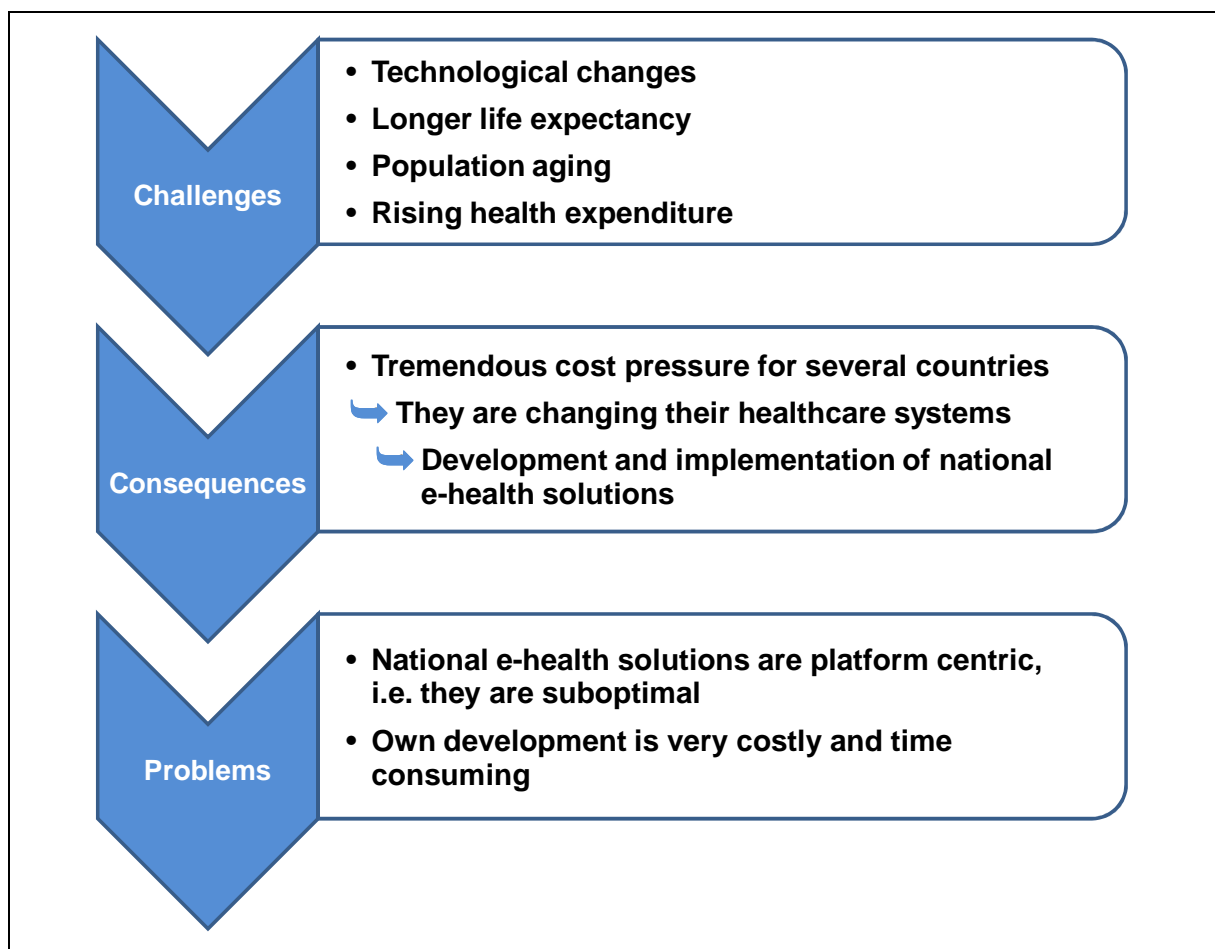
Figure 5: Summary of challenges, consequences and problems that OECD countries are confronted with
[It is important to note that the details of this figure are based on references mentioned earlier in this section]

However, two significant problems arise: firstly, these national e-health solutions are platform centric, meaning that they are suboptimal and not in line with the doctrine of network centric healthcare; secondly, an own development is very costly and time consuming. Consequently, this thesis examines the transferability of national e-health solutions across countries. Thus, an appropriate research question must be stated. This research question is presented in section 1.3; however, beforehand essential definitions are defined. At the end, it should be noted that the derivation of the statement of the problem and several presented facts are already published by the researcher (see Zwicker et al. 2012a).

1.2 Definitions

Before the research question is stated, it is important to clarify essential definitions as explanations are necessary to understand and assess the research question. In the first step, it is important to define tele-medicine, tele-health, e-health, e-health solution, national e-health solution and telematics for health.

The World Health Organization (WHO) defines **tele-medicine** as the "use of telecommunications to diagnose and treat disease and ill-health" (WHO 2012b). For the WHO **tele-health** "is broader in definition than tele-medicine as it includes computer-assisted telecommunications to support management, surveillance, literature and access to medical knowledge" (WHO 2012b).

Based on the study's focus on **e-health**, it is essential to define this term accurately. Therefore, three established definitions of e-health have been selected.

- The WHO defines **e-health** as the transfer of healthcare as well as health resources (e.g. money, health information and medicines) via electronic means (WHO 2012b). Thereby, this includes the "delivery of health information, for health professionals and health consumers" (WHO 2012b), the use of "the power of IT and e-commerce to improve public health services" (WHO 2012b) and the "use of e-commerce and e-business practices in health systems management" (WHO 2012b).

- The Victorian Department of Human Services (VDHS) in Australia defines that **e-health** ensures "that the right health information is provided to the right person at the right place and time in a secure, electronic form for the purpose of optimizing the quality and efficiency of health care delivery" (Victorian Department of Human Services 2008, p. 1).

- The European Commission defines that **e-health** "means the use of modern information and communication technologies (ICT) in support of health and health-related fields, and to meet needs of citizens, patients, healthcare professionals, healthcare providers as well as policy makers" (European Commission 2012).

In the next step, it is essential to define e-health for this study. Because each presented definition has essential aspects mentioned, but none of these three definitions is accurately enough itself, this study uses a combination of all three definitions. However, it is important to note that this study uses the e-health definition from the European Commission as basis. The reason is that the European Commission's focus is more on ICT used in the healthcare environment than the other two definitions. As it was described earlier in the thesis, the use of ICTs especially in e-health solutions is the answer to reacting to increasing healthcare budgets and offering effective and efficient quality of care.

For this study **e-health** means the use of information and communication technologies (ICTs) in support of healthcare and health-related fields, and to meet needs of citizens, patients, healthcare professionals, healthcare providers, policy makers, etc. Thereby, e-health allows the transfer of health resources like health information across health professionals and health consumers via electronic means. In this way, the right health information is provided to the right person at the right place and time in a secure, electronic form with the intension to increase the quality and efficiency of healthcare delivery.

The European Commission defines **e-health solutions** as "products, systems and services that go beyond simply Internet-based applications and encompass tools for both health authorities and professionals as well as personalised health systems for patients and citizens" (European Commission 2012).

Derived from this valid definition for this study, a **national e-health solution** represents the sum of all national e-health products/e-health systems/e-health services/e-health functions of a country, defined by the federal government and/or the responsible national e-health institutions/organizations. This study uses the terms **e-health product**, **e-health system**, **e-health service** and **e-health function** as synonyms.

The WHO defines **telematics for health** as a "composite term for both tele-medicine and tele-health, or any health-related activities carried out over distance by means of information communication technologies" (WHO 2012b).

Another fundamental step is to define **transferability** and **transfer**, especially in the context of national e-health solutions.

- The Department of Environmental Protection in Florida (U.S.) defines **transferability** as "the proposed technology or program would be applicable to many other communities or businesses or individuals to do the same thing in their jurisdictions. Include discussion as to where the technology would be transferable" (Department of Environmental Protection Florida 1999, p. 3).

- The World Intellectual Property Organization (WIPO) defines a **transfer** of technology as "a series of processes for sharing ideas, knowledge, technology and skills with another individual or institution (e.g., a company, a university or a governmental body) and of acquisition by the other of such ideas, knowledge, technologies and skills" (WIPO 2009, p. 4).

Based on these two definitions and the national focus of this study, the **transferability of e-health solutions** is defined in this study as the ability to transfer different national e-health solutions from one country to other countries including ideas, knowledge, technology and skills. However, because this study explores a mainly unknown topic through generating new knowledge and insights, this study sees no necessity to differentiate between transferability and transfer and therefore uses both terms as synonyms.

It is important to note that for this study local adaptations of each receiving country are accepted and still counted as a successful transfer of a national e-health solution from one country to another country. Additionally, this study allows countries to come to a compromise, which means that also the countries, which already have this e-health solution in place, agree to an overall change.

However, the following situations are not counted as a transfer of a national e-health solution from one country to another country:

- Having two own developed national e-health solutions using an interface for data exchange.

- Any kind of interoperability between two own developed national e-health solutions.

- Any kind of applying standards but not transferring a national e-health solution.

The reason for these exclusions is that in such situations no transfer of a national e-health solution has taking place and therefore still different and own developed national e-health solutions exist in parallel.

This thesis uses network centric healthcare on a global scale. Therefore, one **global e-health solution** is the basis for **network centric healthcare**. Because the focus of the study is on e-health, which also contributes to healthcare, both terms are used as synonyms in this study. The doctrine of network centric healthcare operations (NCHO) is defined in section 2.3.

Beneficiary is defined as an "individual who receives benefits from or is covered by an insurance policy or other health care financing program" (AcademyHealth 2004, p. 4). It is important to note that this study uses the term **enrollee** as synonym for beneficiary.

Physician, **medical practitioner (MP)**, **medical doctor (MD)** and **doctor** are used in this study as synonyms. A **general practitioner (GP)** is treated as a particular type of physicians.

It is important to note that this study uses all definitions and terms from this section as presented and/or derived and/or explained.

1.3   Research Question and Objectives

This dissertation examines the following key research question:

How can different e-health solutions be transferred to other countries?

In order to answer this question it is also necessary to explore the following sub-questions:

   i.   **Which are the key factors and barriers that influence the transferability of e-health solutions?**

   ii. **Is the doctrine of network centric healthcare only convertible nationally or is it also realizable globally?**

   iii. **Which e-health functions, ideas and approaches can be transferred across countries and/or different healthcare actors?**

For this study, the research question and its sub-questions are answered by focusing on the specific context of Australia and Germany. These two countries have been chosen for several reasons:

- Both countries have similarities in their healthcare systems as both have a two-tier healthcare system i.e. public and private healthcare. This is important as in both countries it might lead to a similar understanding of healthcare. In addition, because both countries have public health insurance in a major portion, the federal government and the respective national e-health institutions/organizations should have the main authority in case of a development and implementation of a national e-health solution.

- Both countries have made it a national priority to develop an e-health solution for their country, when this research was started. This means that both countries including all involved stakeholders are confronted with the issue of e-health. Therefore, they might identify key factors, barriers and problems, which can arise through the development and implementation of a national e-health solution. A successful national e-health solution is the basis for evaluating the transferability of a national e-health solution to other countries.

Due to the similarities in the healthcare systems and because both countries already started to develop and implement a national e-health solution, it might be possible that they have also a similar understanding of e-health. That means that differences in answers might result less from a different understanding of healthcare and e-health in general rather than through differences in e.g. people, process, technology and e-health requirements. It is important to note that this is only a nice to have and it cannot be guaranteed.

1.4 Importance of the Research

The research question "How can different e-health solutions be transferred to other countries?" is an important research question. Section 1.1 has shown that there exists several challenges resulting in a significant cost pressure in healthcare globally and many countries are unlikely to maintain their increasing health expenditure. As already mentioned, ICTs in e-health solutions have the potential to reduce healthcare costs and improve quality of care (Wickramasinghe et al. 2005; Wickramasinghe and Schaffer 2010). However, as has been evidenced in other applications of ICT building, islands of automation have had the converse effect and lead ultimately to chaos, information overload and ineffective solutions (Hammer and Champy 1994). Given that to date, it appears that countries in the world are focused on their own e-health solution, which means that the platform centric focus is likely to develop in healthcare (von Lubitz and Wickramasinghe 2006). This situation is not only unfavorable regarding costs, it is also not in tune with the doctrine of network centric healthcare

(Wickramasinghe et al. 2007; Wickramasinghe and Schaffer 2010). Therefore, it is essential to investigate how to realize an appropriate e-health design. To do this, it is necessary to understand how to transfer different national e-health solutions to other countries and thereby to develop a global e-health solution. This in turn should have the potential to reduce costs and improve the quality of healthcare delivery worldwide.

Moreover, the impact of this study is far reaching as it affects everybody, because healthcare delivery is relevant for all people in the world. In addition, as human life depends on healthcare, this research could also contribute to life savings in the future. Therefore, this study not only addresses an important gap in the literature and addresses a critical need, it also makes a contribution to practice and society.

1.5   Thesis Outline

This dissertation consists of six chapters.

Chapter 1 states the research problem, the essential definitions, the research question and objectives as well as the importance of the research.

Chapter 2 presents the literature review including the presentation of different healthcare systems, different national e-health solutions, the underlying theory of this study namely network centric healthcare as well as cultural aspects.

Chapter 3 outlines the methodology and research design. This study uses a mixed research approach. Further, the case study research in Australia and the case study research in Germany use interviews and also a questionnaire. In addition, an ethnographic study in Australia and an ethnographic study in Germany are adopted. This chapter also explains the necessary ethics considerations.

Chapter 4 demonstrates the data analysis and the findings for each data collection method. Based on thematic analysis, the interview results are structured as expected findings and emerging findings for each country. Further, the emerging themes are identified and stated. Based on these results, the significant findings are presented. Moreover, this chapter presents the findings of the questionnaire and further the results of the ethnographic study in Australia and the ethnographic study in Germany.

Chapter 5 discusses the different findings of the interviews including the emerging themes. Further, triangulation of the findings, which are achieved through the different data collection

methods, is conducted. In addition, this chapter mentions further useful facilitators, which can help for the realization of a successful transfer of a national e-health solution. Moreover, the key lessons learned from this study are mentioned.

Chapter 6 presents the conclusions of this research. This chapter confirms how the findings answer the research question and its sub-questions. Furthermore, the contributions to theory and recommendations for theory, the contributions to practice and recommendations for practice, the key limitations, the outlook for future studies and the concluding remarks are stated.

CHAPTER 2

2. Literature Review

Firstly, the literature review presents different types of healthcare systems. Secondly, this chapter presents and discusses e-health including necessary considerations and preparations for e-health, the "e's" in e-health, the explanation of the different e-health solutions from Australia and Germany as well as a comparison/contrast of these national e-health solutions. Thirdly, this chapter explains the doctrine of network centric healthcare as this is the underlying theory of this study. Fourthly, this chapter highlights facts about culture, because this study is focused on different countries and therefore cultural differences might have an impact on the outcome of the study. Finally, a summary of this chapter is given.

2.1 Different Types of Healthcare Systems

There exist different types of healthcare systems, mostly private healthcare systems (e.g. United States), mostly public healthcare systems (e.g. United Kingdom) and two-tier healthcare systems (e.g. Australia and Germany). These different types of healthcare systems can be seen as a continuum. Figure 6 shows the healthcare system continuum. This continuum can be used for categorizing national healthcare systems.
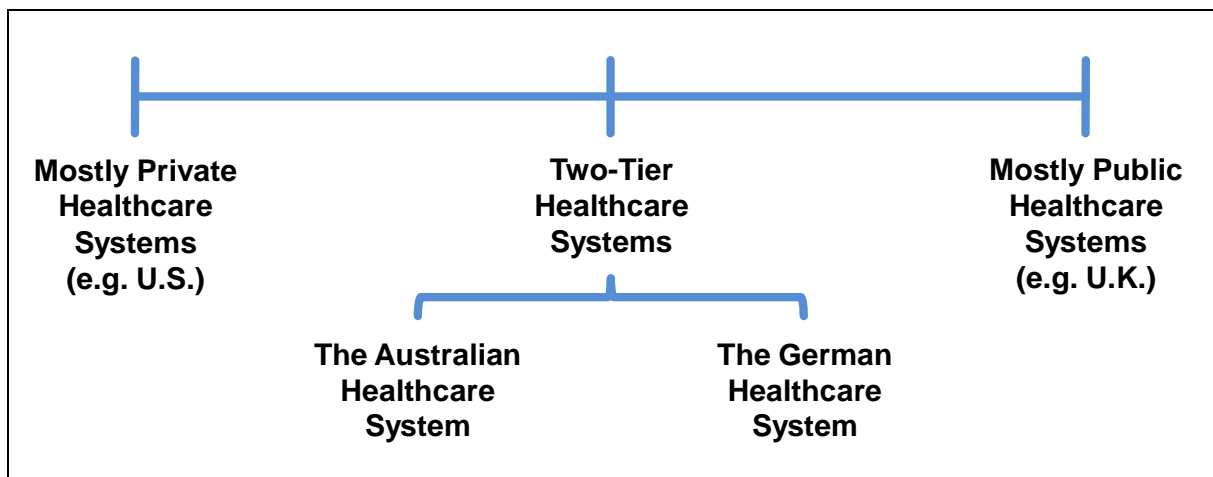
Figure 6: Healthcare system continuum (adapted from Wickramasinghe et al. 2006; Zwicker et al. 2012a)

Subsection 2.1.1 explains the United States healthcare system as example for a primarily private driven healthcare system. Subsection 2.1.2 explains the United Kingdom healthcare system as example for a mostly public driven healthcare system. Subsection 2.1.3 explains two-tier healthcare systems, and thereby especially the Australian healthcare system (see subsection 2.1.3.1) and the German healthcare system (see subsection 2.1.3.2).

2.1.1 Private Healthcare Systems (e.g. United States)

This study mentions the United States (U.S.) healthcare system as an example of a mostly private driven healthcare system, because healthcare in the U.S. relies strongly on private health insurance and health expenditure is funded to a large extent through private payers and individuals (Porter and Teisberg 2006; Kongstvedt 2009; Leiyu and Douglas 2010). In addition, compared to other countries, the U.S. does not have an overall national healthcare delivery program and therefore a general access to healthcare delivery for all people is not given currently (Leiyu and Douglas 2010). Further, most outpatient physicians are working within private practices (The Commonwealth Fund 2011).

One major reason for the lack of a universal healthcare delivery system is the existence of several subsystems, which are not managed centrally (Leiyu and Douglas 2010). Therefore, the U.S. healthcare system is more a multiplicity of some public and mostly private organizations and facilities, which manage healthcare delivery than in fact a nationwide healthcare system (The Commonwealth Fund and Squires 2010). Nevertheless, this circumstance does not exclude the fact that the U.S. federal government and the state governments may have an impact on the U.S. healthcare system since a substantial amount of financing is still provided by them (Kongstvedt 2009; Leiyu and Douglas 2010). However, this money is generally intended for military personnel and mostly for the support of vulnerable people including very poor people, elderly people, disabled people and uninsured people (Leiyu and Douglas 2010).

In 2010, 56 % of U.S. inhabitants were able to receive private healthcare coverage, while 27 % received their healthcare coverage from public programs like Medicare (14 %), Medicaid (12 %) and military programs (1 %) (The Commonwealth Fund 2011). Alarmingly, 16 % of the population (around 50 million residents at that time) had even no access to any health insurance coverage (The Commonwealth Fund 2011). Along the insured population, 29 million people had to deal with very high out-of-pocket payments, which also lead to a significant cost pressure for these insured people (The Commonwealth Fund 2011). Compared to 2008, where 60 % of the U.S. inhabitants had private healthcare coverage, 24 % had healthcare coverage from federal programs and 15 % of the population (46 million residents) were uninsured, a dramatically shift to more uninsured people can be identified (The Commonwealth Fund 2010).

Another certain problem for the U.S. is the fact of very high health expenditure (OECD 2011a). In 2009, the U.S. total health expenditure was 17.4 % of GDP and US$ 7,960 (PPP)

per capita (OECD 2011d; OECD 2011e). Both U.S. values represented the highest value compared to the other OECD countries (OECD 2011d; OECD 2011e). For more details see also section 1.1.

The finance structure of the U.S. healthcare system is (The Commonwealth Fund 2011):

- Within the U.S, private health insurance coverage is offered by over 1,200 for-profit and not-for-profit health insurance companies. Thereby, the people can pay the coverage by their own or through tax-free voluntary premiums, contributed by employers as well as employees. It should be noticed that in the U.S., employer coverage is the most common type.

- The U.S. national social insurance program managed by the federal government is called Medicare. The focus of Medicare relies in general on the elder population (65 or older) as well as certain disabled people under 65 (Kongstvedt 2009; Leiyu and Douglas 2010). The financing is assured with premiums, payroll taxes as well as federal general revenues.

- In the U.S., specific people with low-income can get health insurance coverage through Medicaid, which is managed by the different states (Kongstvedt 2009; Leiyu and Douglas 2010). While the different states manage Medicaid, the federal government pays matching funds to them. In 2011, depending on the state, matching funds varied between 50 % and 73.2 %.

- Out-of-pocket expenses represent an important amount within the U.S. healthcare system. They can be based on cost-sharing health insurance agreements or can be direct payments from individual households. In 2009, around 12.3 % of U.S. total health expenditure came from out-of-pocket spending (OECD 2011f).

Overall, the problem with the United States healthcare system is not only the problem of high costs or structural problems, but rather the dangerous combination of very high healthcare costs, lack of value-based competition, lack and wrong focus of healthcare reforms, numerous errors, variations in quality of care, as well as restricted access to healthcare (Porter and Teisberg 2006).

In addition, for U.S. healthcare consumers the payoff between the very high healthcare costs in contrast to their achieved quality of care is unknowable (Porter and Teisberg 2006). In fact, they feel a higher level of dissatisfaction compared to patients of other developed countries

(Porter and Teisberg 2006). This perception is especially affirmed by low-income patients, where the problem of healthcare access and high healthcare costs especially preponderate (Porter and Teisberg 2006). This dissatisfaction is also founded, because even if healthcare in the U.S. is in several areas excellent and the U.S. health spending is tremendous, these facts do not lead to higher expectancy of life compared to other developed countries or more healthy years (Porter and Teisberg 2006).

Based on all these facts and further challenges (see section 1.1), it is essential that the U.S. healthcare system will change within the next years. U.S. president Obama and his federal government have realized this need and therefore they have adopted new healthcare reforms. In March 2010, Obama made it a national priority to establish a "Patient Protection and Affordable Care Act", which provides several reforms like e.g. (The Commonwealth Fund 2011):

- An extension of people, who have the right for Medicaid coverage.

- More funding through the federal government to improve the situation for low-income inhabitants, but also for uninsured inhabitants.

- The creation of an Independent Payment Advisory Board, which is responsible for curbing health spending of Medicare.

- The foundation of the Patient Centered Outcomes Research Institute, which is in charge of the realization of necessary studies.

These steps are essential for the U.S. healthcare system in order to come along with its challenges. However, these reforms are unlikely to solve all problems, because fundamental and structural problems cannot be solved through single reforms (Porter and Teisberg 2006). Therefore, for long-term success, it will be necessary to evaluate and restructure the complete U.S. healthcare system. However, this will be a challenging endeavor based on the fragmented and mostly private healthcare system. It will be interesting to follow, if the U.S. healthcare system will move to a two-tier healthcare system.

2.1.2 Public Healthcare Systems (e.g. United Kingdom)

As an example for a mostly public healthcare system, this study presents the healthcare system of the United Kingdom (U.K.). The reason is that healthcare in the U.K. is to a great extent based on the National Health Service (NHS) (Boyle 2008; Greener 2009). The NHS

offers universal healthcare coverage, which is mostly free of charge at the point of use, for all people in the U.K., who are ordinarily residents (Boyle 2008; Greener 2009). Additionally, private health insurance is offered, which supplements the NHS system (Boyle 2008).

The United Kingdom consists of England, Northern Ireland, Scotland and Wales (Boyle 2011). In 2009, around 51.8 million people or in other words around 83.8 % of U.K.'s population came from England (Boyle 2011). Outside of England, the devolved administrations of the other countries (i.e. Northern Ireland, Scotland and Wales) are responsible for the health services (Hawe et al. 2011; Harker 2012). Moreover, the NHS structure differs across the U.K. countries (Harker 2012). The main disparity among these countries is based on the different role of the internal market (Harker 2012).

In 2009, U.K.'s total health expenditure was 9.8 % of GDP and US$ 3,487 (PPP) per capita (OECD 2011d; OECD 2011e). At the same time, the average of the OECD countries was around 9.6 % of GDP and US$ 3,233 (PPP) per capita (OECD 2011d; OECD 2011e). Both U.K. values exceeded slightly the average of the OECD countries. For more details see also section 1.1.

Furthermore, UK's public health expenditure was 8.2 % of GDP and US$ 2,935 (PPP) per capita in 2009 (OECD 2011d; OECD 2011e). This means that public health expenditure contributes for around 84.1 % of UK's total health expenditure in 2009 (OECD 2011f).

The finance structure of the U.K. healthcare system is (Boyle 2008):

- As already mentioned, the main anchor of U.K.'s healthcare system is the NHS. The funding of the NHS is largely based on central (U.K.) taxation (Harker 2012). Furthermore, NHS generates income through charges like prescription or dental charges (Harker 2012).

- Private health insurance companies can be not-for-profit or for-profit. Laing and Buisson indicate that only 10.4 % of the U.K. population had used private health insurance in form of private medical insurance in 2008 (as cited in Boyle 2011; Hawe et al. 2011). Thereby, enrollees have to pay a subscription (Hawe et al. 2011). Private health insurance opens the way for conditions like e.g. a wider option of specialists or a quicker access to the necessary treatment (Hawe et al. 2011). In 2009, around 1.1 % of U.K.'s total health expenditure was financed by private health insurance (OECD 2011f).

- In 2009, around 10.5 % of U.K. total health expenditure was out-of-pocket expenses (OECD 2011f).

Compared to the U.S. healthcare system, the certain problem of uninsured people does not apply to the United Kingdom. However, the U.K. healthcare system has also to deal with rising health expenditure and other challenges (see section 1.1).

Therefore, the U.K. has also to introduce new reforms. Because England has by far the highest population within the U.K. and because most of the current publications mention healthcare facts especially for England, this study gives an overview of reforms based on England. Examples of reforms are (Department of Health U.K. 2010; Harrison et al. 2011):

- The abolishment of the Strategic Health Authorities as part of the restructuring of the healthcare system.

- The creation of the new NHS Commissioning Board as part of the restructuring of the healthcare system.

- Increase the power of patients.

- Enhance the quality of care.

- Reduce costs.

It is important to note that the U.K. including NHS has to learn from problems in the past. These problems included: the managers were blamed to be responsible for the problems, clinicians' focuses were shifted from clinical services to new services, the plan of essential services was very challenging due to new market reforms and there was a gap between available health services and health service expectations from the general public (Greener 2009). Thus, it is important to involve doctors and other stakeholders into policy development as they can help to improve health services (Greener 2009).

2.1.3 Two-Tier Healthcare Systems (e.g. Australia and Germany)

Generally, in two-tier healthcare systems, there exist both a public funded healthcare system and a private funded healthcare system (Standing Senate Committee on Social Affairs, Science and Technology 2001). In this context, private health insurance can have a complementary, a supplementary and a substitutive function, which are explained in the following (Foubister et al. 2006).

Complementary private health insurance is looking for the completeness and therefore covers lacks in scope and in depth, which are not covered through the public health insurance (Foubister et al. 2006). An example for scope to mention is dental care, because typically payments for replacements, coronas, etc., are partly excluded or completely excluded in public health insurance (Foubister et al. 2006). An example for covering lacks in depth is user charges, which are requested before patients are able to have access to their care (Foubister et al. 2006).

Supplementary private health insurance is looking on alternative insured access (Foubister et al. 2006). This kind of insurance is especially demanded, where people are unsatisfied with their public healthcare system and where people are willing to pay beside public health insurance also for a private health insurance (Foubister et al. 2006). An example is to get access to a superior or private room (Foubister et al. 2006).

Substitutive private health insurance is dealing with the issue of system inclusiveness (Foubister et al. 2006). This means that the focus is here on people, who are prohibited to be enrolled in public health insurance or who are able to opt-out of public health insurance based on e.g. their yearly income (Foubister et al. 2006). In such cases, the private health insurance takes a substitutive function (Foubister et al. 2006). This means that people being enrolled in substitutive private health insurance are not enrolled (anymore) in public health insurance (Foubister et al. 2006).

This study defines two-tier healthcare systems as healthcare systems, where beside a primarily used public/statutory healthcare system also a well-established and well-used private healthcare system exists. Thereby, the private healthcare system can have a complementary and/or supplementary function (Foubister et al. 2006). Depending on the country, the private healthcare system can also have a substitutive function (Foubister et al. 2006). Factors like for example earnings or job status can influence the admission to the private healthcare system (Foubister et al. 2006).

Two-tier healthcare systems are common in several OECD countries around the globe. Because the study's focus is primarily on Australia and Germany, which have both a two-tier healthcare system, it is necessary to present their healthcare systems in turn. Subsection 2.1.3.1 presents the Australian healthcare system, while subsection 2.1.3.2 mentions the German healthcare system.

2.1.3.1 The Australian Healthcare System

The Australian healthcare system is an example of a two-tier healthcare system. Thereby, Australia has a national (public) health insurance system, which is based on Medicare (Healy 2012). Medicare offers universal health insurance for Australian citizens and permanent residents (Healy 2012). In addition, private health insurance is offered in order to complement and supplement the public system (Healy 2012).

In 2009, Australia's total health expenditure was 9.1 % of GDP and US$ 3,670 (PPP) per capita (OECD 2012c). In the same year, the average of the OECD countries was around 9.6 % of GDP and US$ 3,233 (PPP) per capita (OECD 2011d; OECD 2011e). Based on these facts, it can be seen that Australia's total health expenditure in relation to GDP felt below the average of the OECD countries, while Australia's total health expenditure per capita exceeded the OECD average. For more details see also section 1.1.

The finance structure of the Australian healthcare system is (Healy 2012):

- Medicare is nowadays an Australian government agency, which is administered by the Australian federal government. The funding of Medicare is largely based on general tax income. In addition, a 1.5 % levy based on taxable income is collected. However, low-income people can be excused from this levy or their levy can be reduced. In addition, people with high income have to pay an extra 1 % levy on their taxable income, if they are not using private hospital cover. Between 2009 and 2010, the governments funded 69.9 % of Australia's total health expenditure. While 43.6 % were covered from the Australian federal government, 26.3 % were covered through state and territory governments.

- In Australia, private health insurance companies can be non-profit or for-profit (Healy et al. 2011). In 2009, 7.6 % of Australia's total health spending came from private health insurance. While in June 2012 around 46.8 % of Australia's population used private hospital insurance, 54.4 % used general treatment coverage. Since 1999, the Australian government has decided to support people, who want to use private health insurance (Healy et al. 2011). Since that time, people using a private health insurance receive a 30 % rebate on their premiums (Healy et al. 2011). This rebate increases for elderly people (Healy et al. 2011). However, since July 2012, this rebate is linked to individual's income. Moreover, it is important to note that private health insurance is community-rated in Australia, which means that normally all private enrollees pay for

the same policy the same amount of premiums, independent of their risks (Healy et al. 2011; Department of Health and Ageing Australia 2012a).

- In 2009, 18.5 % of Australia's total health expenditure was out-of-pocket expenditure. Examples for such out-of-pocket spending are payments for dental services and copayments.

Given the fact that Australia offers universal health insurance for Australian citizens and permanent residents, Australia is not confronted with the serious problem of uninsured people like the United States.

Furthermore, private health insurance is widespread in Australia and the Australian federal government encourages people to use private health insurance. This fact separates the Australian healthcare system from the U.K. healthcare system and it is therefore also one of the reasons, why the Australian healthcare system is classified as a two-tier healthcare system, while the U.K. healthcare system counts mostly as a public healthcare system.

Because Australia has also to deal with rising health expenditure and further challenges (see also section 1.1), several reforms have been decided like e.g. (Healy 2012):

- The arrangement of several reviews of the Australian healthcare system in order to find potential for improvement and to identify and eliminate problems.

- The creation of new agencies and authorities to improve the healthcare system, its performance and healthcare delivery.

- The Australian government and the states will work closely together in order to reorganize the joint funding for the disability services. The goal is a National Disability Insurance Scheme.

2.1.3.2 The German Healthcare System

The German healthcare system is another example of a two-tier healthcare system. Further, Germany has statutory health insurance and private health insurance (Busse et al. 2011). On the one hand, private health insurance complements and supplements the statutory health insurance, but on the other hand private health insurance also substitutes the statutory health insurance (Busse et al. 2011). Before the details are presented, it should be noted that some references used in this section are in German and therefore requests translations.

Based on a legal regulation coming into effect in January 2009, it is mandatory for all German citizens and permanent residents to be enrolled in a health insurance plan, i.e. in the statutory health insurance plan or on the other hand in the substitutive private health insurance plan (Busse et al. 2011). In general, employees as well as further groups like e.g. pensioners are mandatory enrolled in the statutory health insurance (Busse et al. 2011). However, employees, whose earnings exceed 4.350 € per month or 52.200 € per year (numbers are based on 2013), have at the end of the year the right to leave the statutory health insurance voluntarily and to use instead private health insurance as substitute (BMG 2013; Busse et al. 2011). Nevertheless, it is important to note that the enrollee's income has also to exceed the valid threshold of the following year (BMG 2013).

In 2011, the Federal Ministry of Health, in German Bundesministerium für Gesundheit (BMG), states that around 69.67 million people including pensioners were enrolled in the statutory health insurance scheme (BMG 2012). At the same time, about 8.98 million people were enrolled in a substitutive private health insurance (Verband der privaten Krankenversicherung 2012). Additionally, there existed in total around 22.5 million completed contracts in complementary and supplementary private health insurance programs, whereas one person can have several contracts or one contract can insure several people (Verband der privaten Krankenversicherung 2012).

On 1st January 2013, Germany had 134 statutory health insurance companies (GKV-Spitzenverband 2013). On 30th September 2012, the German Association of Private Health Insurers, in German Verband der privaten Krankenversicherung e.V., had 43 ordinary members, four extraordinary members as well as two associated facilities (Verband der privaten Krankenversicherung 2012). In 2011, the members of the German Association of Private Health Insurers account for more than 99.9 % of all private premiums (Verband der privaten Krankenversicherung 2012).

In 2009, Germany's total health expenditure was 11.6 % of GDP and US$ 4,218 (PPP) per capita (OECD 2011d; OECD 2011e). Concurrently, the average of the OECD countries was around 9.6 % of GDP and US$ 3,233 (PPP) per capita (OECD 2011d; OECD 2011e). Germany has clearly exceeded both numbers. For more details see also section 1.1.

The finance structure of the German healthcare system is (Busse et al. 2011):

- Statutory health insurance companies are autonomous and not-for-profit oriented. They are nongovernmental bodies, but statutorily regulated. They are competitors

among each other and therefore they try to acquire enrollees as much as possible. The statutory health insurance is financed through compulsory premiums charged as a percentage of gross wages or pensions up to a defined maximum. Currently, Germany has a universal premium by law, which accounts for 15.5 % of each individual's gross wage or pension (BMG 2013). Employees and pensioners pay 8.2 % of their gross wage respectively pension, whereas employers and pension insurance institutes pay another 7.3 % (Blümel 2012; BMG 2013). Non-working spouses and kids are included costless. People, who are unemployed, are also using this kind of health insurance. In 2009, 57.8 % of Germany's total health expenditure came from statutory health insurance. At the same time, total public health expenditure (including e.g. taxes and long-term care) amounted to around 76.9 % of total health expenditure (OECD 2011f).

- Private health insurance has different functions in Germany. As a substitute for statutory health insurance, private health insurance covers two groups, who are basically excluded from statutory health insurance. One group encompasses self-employed people. The other group includes civil servants, who receive from the employer to some extent a reimbursement of their healthcare costs. In addition, substitutive private health insurance covers those people, who have firstly fulfilled the requirements and secondly have decided to leave the statutory health insurance scheme. The premium of an enrollee using substitutive private health insurance depends on his/her risk. Dependents have to pay also a premium. In order to have appropriate premiums, the federal government adopts regulations. In 2009, a basic insurance had to be established, which especially targets those people who cannot use statutory health insurance and who are not able to pay a risk-based premium. In addition, private health insurance has a complementary and supplementary function. These private health insurance plans cover e.g. copayments for specific dental services or allow better conditions in hospitals. In 2009, about 9.3 % of Germany's total health expenditure came from private health insurance (OECD 2011f).

- In 2009, out-of-pocket payments accounted for around 13.1 % of Germany's total health expenditure (OECD 2011f).

It is important to note that the German healthcare system is based on self-government (Porter and Guth 2012; BMG 2013). This means that the federal government and the Federal Ministry of Health specify the legal framework and the tasks, while the healthcare system organizes itself in its own responsibility (Porter and Guth 2012; BMG 2013). In this context,

the Federal Joint Committee, in German Gemeinsamer Bundesausschuss, "is the highest decision-making body of the joint self-government of physicians, dentists, hospitals and health insurance funds in Germany" (Gemeinsamer Bundesausschuss 2013). This self-government structure differentiates the German healthcare system from other healthcare systems like e.g. the U.K. healthcare system (Porter and Guth 2012; BMG 2013). One reason is that U.K.'s NHS is centrally driven (Porter and Guth 2012).

Germany's healthcare system like all other OECD countries' healthcare systems is also confronted with several challenges including rising health expenditure (see also section 1.1). Therefore, several reforms were established like e.g. (Busse et al. 2011):

- The creation of several incentives to reduce the usage of health services.

- The increase of the competition.

- The creation of sustainability in the area of healthcare funding.

Overall, it is important for Germany to move to a value-based healthcare system, i.e. to improve and maximize the value and benefit for the patients (Porter and Guth 2012). This means that healthcare needs a permanent improvement (Porter and Guth 2012). In this way, it is essential to measure and examine the quality of care, the outcomes and the incurred costs and then to contrast them against each other (Porter and Guth 2012). This information will help to reorganize healthcare delivery (Porter and Guth 2012).

2.1.4 Summary of the Different Presented Healthcare Systems

Section 2.1 shows that different types of healthcare systems exist, i.e. mostly private healthcare systems, mostly public healthcare systems and two-tier healthcare systems. Based on this, the healthcare system continuum is illustrated. As example for a mostly private healthcare system, the U.S. healthcare system is mentioned. As example for a mostly public healthcare system, the U.K. healthcare system is explained. Further, the Australian healthcare system and the German healthcare system are demonstrated, as they are examples for two-tier healthcare systems. In this context, it should be noted that some facts presented in section 2.1 (mainly about Australia and Germany) are already published by the researcher (see Zwicker et al. 2011; Zwicker et al. 2012a; Zwicker et al. 2012b; Zwicker et al. 2014).

Figure 7 gives a summary of the presented healthcare systems. The summarized facts depend on different references and years, which are mentioned in the respective subsection.

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Private healthcare system (mostly)

- No universal healthcare delivery system.
- Several subsystems exist.
- 56 % have private healthcare coverage.
- 27 % receive public healthcare coverage: Medicare (14 %), Medicaid (12 %) and military programs (1 %).
- 16 % are uninsured.

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Public healthcare system (mostly)

- National Health Service (NHS) offers for all ordinarily residents in the U.K. universal healthcare coverage, which is mostly free of charge at the point of use.
- Only 10.4 % use supplementary private health insurance.

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Two-tier healthcare systems

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- Medicare (government agency) offers universal health insurance for Australian citizens and permanent residents.
- Private health insurance complements and supplements the public system: 46.8 % use private hospital insurance and 54.4 % use general treatment coverage.

</td>
<td>

- Health insurance is mandatory for the German citizens plus permanent residents since 2009.
- ~ 69.67 million people including pensioners have statutory health insurance.
- ~ 8.98 million people have substitutive private health insurance.
- There exist in total ~ 22.5 million completed contracts in complementary and supplementary private health insurance programs.
- System is based on self-government.

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Figure 7: Overview of different healthcare systems

In summary, figure 7 highlights that none of the presented healthcare systems is exactly like the other healthcare system, even if they relate to the same category within the healthcare system continuum.

2.2   E-Health

This section explains necessary considerations and preparations for e-health (subsection 2.2.1). Furthermore, the "e's" in e-health are presented (subsection 2.2.2). Moreover, a detailed explanation of the Australian e-health solution (subsection 2.2.3) and the German e-health solution (subsection 2.2.4) is given, followed by a comparison/contrast of these national e-health solutions (subsection 2.2.5). As mentioned earlier in this thesis, these two countries were chosen as they represent examples of two-tier healthcare systems.

2.2.1 Necessary Considerations and Preparations for E-Health

As chapter 1 has shown, several countries are confronted with serious challenges and therefore they are looking for e-health solutions in order to counter to these challenges. However, before e-health solutions can be developed and/or implemented, there are several considerations and preparations to be made.

Firstly, the healthcare environment includes several healthcare players (Wickramasinghe and Schaffer 2010). All these healthcare players are interconnected, as shown in figure 8.
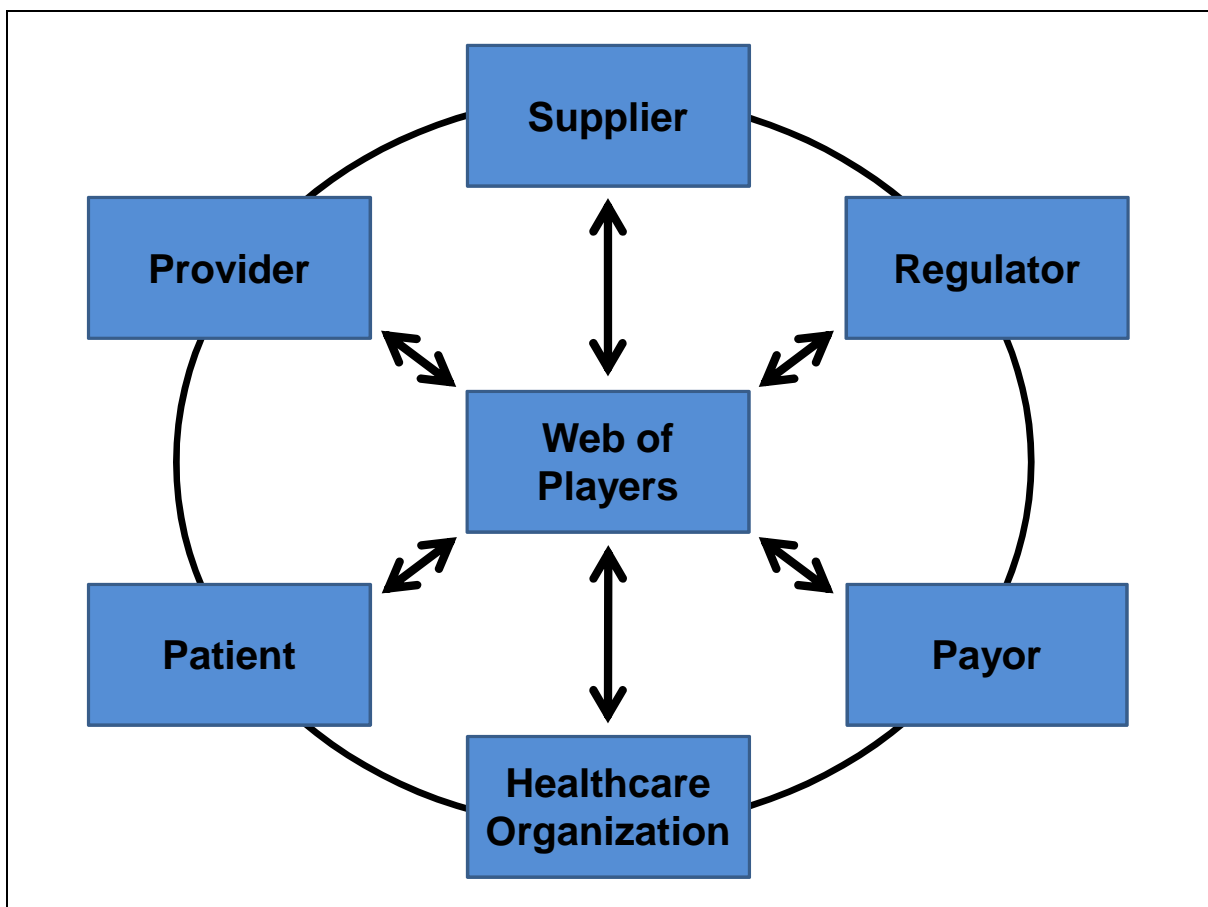
Figure 8: Web of healthcare players (adapted from Wickramasinghe and Schaffer 2010)

As it can be seen in figure 8, this means that the different players have to work with each other, but also depend on each other. This is very important to note, because changes in the healthcare environment can have an impact for several players, in different ways and degree. Because e-health is part of healthcare, these circumstances are also applicable for e-health. This means for example that a national e-health solution, a transfer of a national e-health solution or even a global e-health solution has also to consider the interaction of different healthcare players. Furthermore, it is very important to ensure that all stakeholders are involved in the development and/or implementation procedure of such a solution in order to receive a successful and accepted e-health solution (Wickramasinghe and Schaffer 2010).

Secondly, especially due to the already mentioned technological, demographic, and financial challenges, the healthcare stakeholders need to be focused on three key components (Wickramasinghe and Schaffer 2006; Wickramasinghe and Schaffer 2010): **access** – anyone at anytime at anywhere; **quality** – offer excellent care and set up integrated repositories for information; **value** – by making healthcare delivery available, which is effective and also efficient. It is important to note that all three components are linked through an interconnection (Wickramasinghe and Schaffer 2006; Wickramasinghe and Schaffer 2010). Therefore, they have to be considered as a whole, in order to fight against the current challenges (Wickramasinghe and Schaffer 2006; Wickramasinghe and Schaffer 2010). For the realization, especially e-health is needed (Wickramasinghe et al. 2005; Huang et al. 2010; Wickramasinghe and Schaffer 2010).

Thirdly, the literature has identified four preconditions, which are necessary and critical for the success of e-health and e-health solutions (Wickramasinghe et al. 2005; Huang et al. 2010; Wickramasinghe and Schaffer 2010):

1. The necessary ICT infrastructure (i.e. cables, wideband lines, DSL, etc.) must be available or developed and/or implemented, before countries can have a national e-health solution.

2. The creation of standardization protocols, policies and procedures is essential and very important, because without getting standardization the overall benefits of e-health cannot be received.

3. The user access must be given and handled and therefore accessibility policies including access rights and the necessary user infrastructure (i.e. websites, PCs, etc.) are required.

4. The availability of governmental regulation and control is important in order to create the regulatory framework for e-health including guaranteeing the rights, the security and the privacy of patients.

Depending on the countries' initial situations, countries can have a lot of preparatory work for ensuring the availability of necessary ICT infrastructure, the necessary arrangements for standardization, the user accessibility and finally the necessary laws (Wickramasinghe et al. 2005; Huang et al. 2010; Wickramasinghe and Schaffer 2010). It is important to note that all four prerequisites have to be fulfilled in order to be ready for e-health and for using it adequately and fully (Wickramasinghe et al. 2005; Huang et al. 2010; Wickramasinghe and Schaffer 2010).

Finally, it is necessary to consider that by using e-health, the healthcare environment can be essentially changed in following three ways (Maheu et al. 2001):

1. The information inflow for patients is improving.

2. Patients are getting more involved in the management of their own healthcare.

3. The efficiency of healthcare delivery is increasing.

This section has shown that countries need to focus on several considerations and preparations, before they can develop and/or implement a national e-health solution. These issues are also essential to consider when looking at the transfer of national e-health solutions.

2.2.2 The "e's" in E-Health

In the context of e-health, the "e" does not only signify "electronic" (Eysenbach 2001). Eysenbach allocates ten further meanings (Eysenbach 2001). Table 2 compiles Eysenbach's ten e's in e-health in tabular form and gives a description of each goal. These facts are already partly published by the researcher (see Zwicker et al. 2012b; Zwicker et al. 2012c).

It is important for countries to recognize and consider these goals of e-health, while working on their national e-health solutions. This means that they have to incorporate these goals of e-health during the development, implementation and upgrade of a national e-health solution.

Section 2.2.5 is extending table 2 by evaluating the Australian and the German national e-health solutions for their consideration of the ten e's in e-health. This does not only serve for an evaluation of each national e-health solution, but it also allows a comparison of them.

The e's in e-health	Descriptions
Efficiency	By using e-health it is promised that healthcare efficiency rises, while costs decrease. Thereby, costs could be reduced as a result of e.g. the improved communication across healthcare facilities, the avoiding of needless or duplicative treatments, or the inclusion of patients. This is also supported by the American Institute of Medicine, which states the aim of efficient healthcare (Institute of Medicine U.S. 2001).
Enhancing quality of care	It is important to note that the efficiency enhancement does not only include the decrease of costs, as it should be also considered in combination with the improvement of the quality of care. To enhance the quality of care is one of the ultimate goals of e-health.
Evidence based	It is advisable that the efficiency and effectiveness of e-health interventions are confirmed through an accurate scientific evaluation and with the use of earlier cases. For example, web databases including case information can help to get the required support and information for the diagnosis or treatment on time. However, it is important to note that evidence-based medicine still requests more work.
Empowerment of consumers and patients	With the support of the Internet, it is possible that medicine knowledge bases and also personal electronic records are available for the consumers. In this way, e-health makes new ways for patient-centered medicine possible as well as allows evidence-based choices of patients.
Encouragement	Encourage a true partnership among patients and their healthcare providers, which allows joint decisions.
Education	Online sources allow doctors an ongoing medical education. In addition, consumers can receive e.g. health education or customized information for prevention. These education possibilities facilitate doctors and consumers to be up to date with the most recent medical developments and information.
Enabling	Enables a standardized communication as well as information exchange among different healthcare facilities.
Extending the scope of healthcare	Extending the ambit of healthcare in a geographical and conceptual sense. This allows among others virtual operating rooms and in this way to supply the healthcare services to locations, where these healthcare services are apart from that challenging, difficult or not possible to get.
Ethics	The ethics issue has to be considered as e-health involves new ways of interactions between doctors and patients, but also between the other stakeholders. Furthermore, e-health introduces new challenges as well as threats to ethical affairs like equity or privacy matters.
Equity	By using e-health it is promised that healthcare is getting more equitable. That healthcare gets to a greater extend equitable is also one of the aims mentioned by the American Institute of Medicine (Institute of Medicine U.S. 2001). On the other hand, however, it is not unthinkable that e-health maybe extend the gap among the "haves" and "have-nots". Therefore, this potential threat requests an assured equitable access for all people, independent of e.g. their gender, capabilities and financial situation. Additionally, a robust framework is necessary to make sure that the implementation of the e-health initiatives takes place adequately and correctly.

Table 2: The ten e's in e-health (adapted from Eysenbach 2001; Wickramasinghe et al. 2005)

2.2.3 E-Health in Australia

This section gives an overview of the Australian national e-health solution, which is mainly focused on the Personally Controlled Electronic Health Record (PCEHR).

2.2.3.1 Leading National E-Health Institution/Organization

In July 2005, the National E-Health Transition Authority Limited (NEHTA) was founded by the federal government of Australia and the state and territory governments (NEHTA 2013a). This collaborative enterprise is responsible that the required foundations for the Australian national e-health solution are identified and in a further step developed (NEHTA 2013a). NEHTA has to manage the necessary PCEHR high level architecture and has to support the development of adequate standards (Department of Health and Ageing Australia 2011a).

In detail, NEHTA is specifically focused on following strategic priorities:

1. "Deliver, operationalise and enhance the essential foundations required" (NEHTA 2013b).

2. "Coordinate the progression of priority eHealth initiatives" (NEHTA 2013b).

3. "Manage the delivery of key components of DOHA's PCEHR Programme" (NEHTA 2013b). Thereby, DOHA stands for the Department of Health and Ageing in Australia.

4. "Accelerate national adoption of eHealth" (NEHTA 2013b).

5. "Lead the further progression of eHealth in Australia" (NEHTA 2013b).

Furthermore, the DOHA placed an order with NEHTA, which intended NEHTA to be a managing agent for necessary contracts and agreements with partners like national infrastructure partner/s, etc. (NEHTA 2013b).

2.2.3.2 First Stage

A successful implementation of an Australian e-health solution is very important for several reasons. Firstly, Australia is also confronted with key challenges, i.e. technological changes, longer life expectancy, population aging and rising health expenditure (see section 1.1). Secondly, Australia has the problem that within its healthcare system, especially in the hospital sector, the use of computerized solutions is currently quite low in contrast to its other industries (Pearce and Haikerwal 2010). Thirdly, Australia has also to deal with fragmented

health information as result of several different systems and a multiplicity of different locations (Department of Health and Ageing Australia 2011a). This fragmentation of information is crucial, because delayed health information access may result in lower quality of care, higher risks and increasing costs (Department of Health and Ageing Australia 2011a).

Based on these facts, the Australian federal government had decided in 2010 that a PCEHR system should be developed (NEHTA 2013b). The deadline for the first release was fixed for July 2012, whereupon the core functionality is available and the registration for a PCEHR is possible (Department of Health and Ageing Australia 2011a; NEHTA 2013b). The use of a PCEHR is voluntary and only users of the Australian healthcare system can register for their own PCEHR (Department of Health and Ageing Australia 2011a). To realize the first release, the Australian government had allocated around AU$ 467 million over a two year period in the 2010 budget (Department of Health and Ageing Australia 2011a; NEHTA 2013c).

The secure PCEHR system shall deliver summary records of health information of patients, allow healthcare providers and patients to have a secure access to the requested PCEHR and enable strictly governance and supervision in order to guarantee security and privacy (NEHTA 2013c). In other words, the PCEHR is an electronic health record of a patient, which summarizes key medical information from different distributed systems centrally and securely (NEHTA 2013d). Thereby, the patient himself/herself and authorized healthcare providers, who have the consent of the patient, can access the health information stored in the PCEHR (Department of Health and Ageing Australia 2011a; NEHTA 2013d). This health information can support healthcare providers fundamentally in their decisions and treatments, because the medical history of a patient can be considered (NEHTA 2013d). Looking into the future, the PCEHR will allow also the patient to add own information to his/her PCEHR (NEHTA 2013d). Table 3 gives a summary of the key design features, which the PCEHR system has. Further, this table shows which key design features compared to the used ones the PCEHR system does not have.

Overall, the PCEHR makes several benefits possible. Through the PCEHR e.g. a faster and punctual availability of health information, a higher health information quality, a better communication between the clinicians as well as patients and a higher quality of care can be achieved (NEHTA 2013e).

In 2008, a countrywide quantitative survey including 2,700 people had shown that around 80 % of participants support the idea of an individual electronic health record (NEHTA 2008). However, people's primary concerns encompass data security and privacy (NEHTA 2008).

	The PCEHR system		
is	opt in – if a consumer or healthcare provider wants to participate, they need to register with the system.	and not	compulsory – both consumers and healthcare providers choose whether or not to participate.
is	an enhancement to medical treatment – the PCEHR system will allow a consumer's health information to be shared as and when needed to support the best possible care.	and not	a requirement for medical treatment – if a person does not wish to participate in the PCEHR system, they will continue to be able to access treatment and Medicare benefits.
is	a source of selected clinical data and records – in addition to a shared health summary in each PCEHR (which contains basic health information about a consumer), records may be added to that consumer's PCEHR.	and not	a replacement for normal sharing of information between a consumer and their healthcare provider – as currently occurs in medical practice, existing medical records are used as the starting point for the discussion about the consumer's health, rather than as the complete and authoritative source of current information.
is	an information system – where participating healthcare providers can access additional selected records during a consultation with a consumer.	and not	a communication system – where participating healthcare providers are expected to review any new records loaded into a PCEHR in between consultations with the consumer.
is	aligned with current privacy obligations – healthcare providers will have the same responsibilities in relation to privacy of information in PCEHRs as they currently do in relation to clinical information from other sources.	and not	immune to current sharing and reporting rights and obligations of providers – healthcare providers currently have rights and obligations in relation to disclosure of health information which will continue. These include the ability to access health information in life-threatening situations and the obligation to report a range of disease and child welfare matters to government authorities.
is	a distributed system of service providers working in concert – government and private sector organizations will work together to deliver the PCEHR system to consumers and healthcare providers. The PCEHR system will be underpinned by a legislative framework intended to impose appropriate controls and standards on all the delivery bodies.	and not	a single government store of personal information – while public sector bodies may provide some of the repositories which hold information for the PCEHR system, other private sector organizations may also participate as repositories where they meet relevant specifications and standards.

Table 3: Key design features of the PCEHR system (adapted from Department of Health and Ageing Australia 2011a; Department of Health and Ageing Australia 2011b)

Furthermore, 80 % of the participants had stated that the participation should be optional (NEHTA 2008). Additionally, a significantly high amount of participants had claimed that the Australian federal government should handle the implementation and management (NEHTA 2008). These facts show that a general acceptance for the PCEHR might be expected, when the requirements of the Australian population are considered. It is important to note that for this study, the terms Individual Electronic Health Record (IEHR) and PCEHR are used as synonyms.

In order to develop a national e-health solution for Australia, NEHTA is also working on e-communications in practice. These e-communications are intended to be processed in secure electronic form and are essential for the PCEHR system in order to work/get data:

- **e-Diagnostic Imaging:** exchange of diagnostic images (NEHTA 2013f).

- **e-Discharge Summaries:** exchange of patients' medical reports (NEHTA 2013g).

- **e-Medication Management:** exchange of prescriptions (NEHTA 2013h).

- **e-Pathology:** exchange of pathology results (NEHTA 2013i).

- **e-Referrals:** exchange of referrals (NEHTA 2013j).

An important base component for the PCEHR system is the Healthcare Identifiers (HI) Service. This HI Service consists of three identifiers, namely Individual Healthcare Identifier (IHI), Healthcare Provider Identifier – Individual (HPI-I) and Healthcare Provider Identifier – Organisation (HPI-O) (Department of Human Services Australia 2012; NEHTA 2011a; NEHTA 2013k). Each healthcare identifier represents a unique 16 digit number (Department of Human Services Australia 2012; NEHTA 2013k). The operator of the HI Service is Medicare (NEHTA 2011a; NEHTA 2013k).

The main purpose of these healthcare identifiers is the correct identification and the traceability (NEHTA 2011a; NEHTA 2013k). This means, among others, that health information of a patient is linked with the healthcare identifier of the responsible provider (e.g. a medical doctor) and the responsible organization (e.g. a hospital) (NEHTA 2011a). This gives the possibility of tracing back, who gave the treatment to the patient at which place (NEHTA 2011a). Therefore, the healthcare identifiers are also increasing the security and the confidence regarding the health information of a patient (NEHTA 2011a; NEHTA 2013k). The following figure 9 illustrates this HI Service.
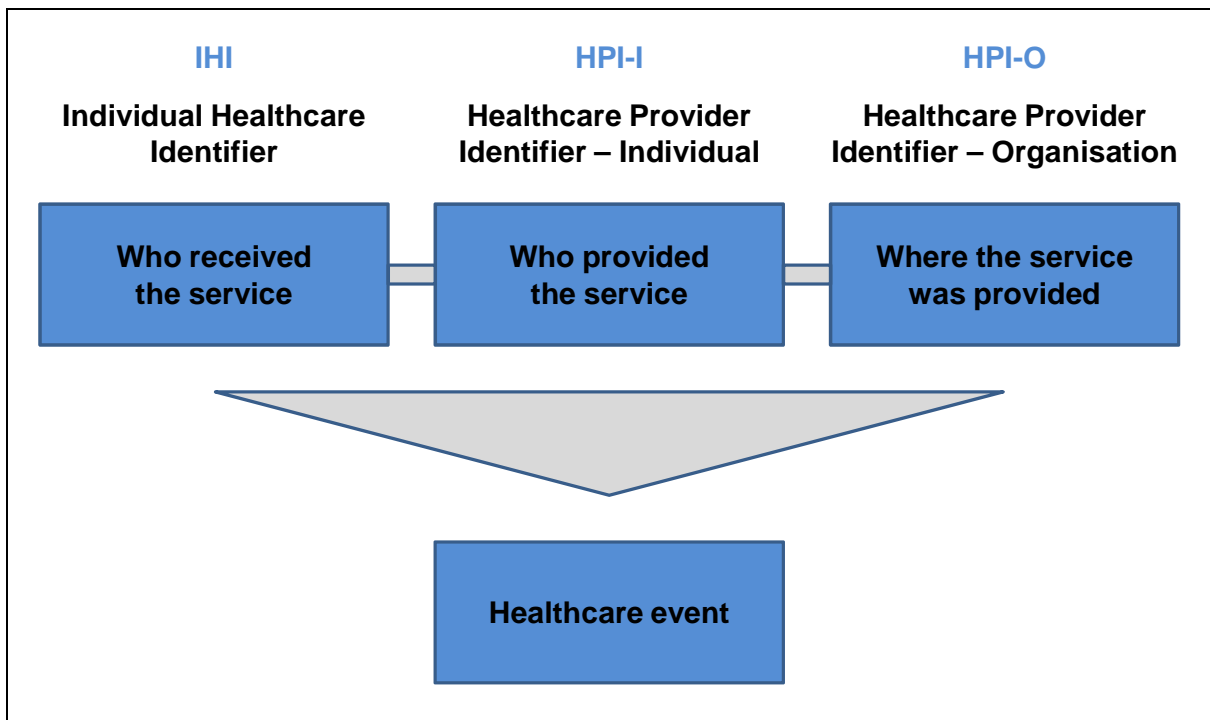
Figure 9: Overview of the Australian Healthcare Identifiers Service (adapted from NEHTA 2011a)

It should be noted that several facts of this section are already published by the researcher (see Zwicker et al. 2012a; Muhammad et al. 2013a; Zwicker et al. 2014).

2.2.3.3 Second Stage

Since 1st July 2012, it is possible for users of the Australian healthcare system to register for their own PCEHR (Department of Health and Ageing Australia 2012b). The necessary infrastructure is already established in Australia, while the PCEHR system itself is still in the rollout phase and thus needs further work (Department of Health and Ageing Australia 2012b). Moreover, Medicare information is already included in the PCEHR system (Department of Health and Ageing Australia 2012b).

In addition, healthcare organizations are able to register for the PCEHR system (Department of Health and Ageing Australia 2012b). Thereby, they can give their employees, i.e. physicians, nurses, etc., the authorization for using the PCEHR system (Department of Health and Ageing Australia 2012b). In this way, these employees can access the PCEHRs of patients via the secure online portal for providers; however, provided that the patients have already registered for their own PCEHR and, with the exception of emergencies, they agree to this proceeding (Department of Health and Ageing Australia 2011a; Department of Health and Ageing Australia 2012b). Nevertheless, patients' health data need to be uploaded to the PCEHR system, before the system can be used appropriately and the benefits can be realized.

Deloitte has calculated that through the PCEHR system around AU$ 11.5 billion net direct benefits can be achieved for the community between the 15 years timeframe of 2010 and 2025 (Deloitte 2011). In detail, it is expected that the governments get net direct benefits of about AU$ 9.5 billion, while the private sector including private households, private hospitals and general practitioners achieves net direct benefits of approximately AU$ 2 billion (Deloitte 2011).

The forecasted net direct benefits of the PCEHR system between 2010 and 2025 are the result of two foremost reasons (Deloitte 2011). Firstly, it is expected that due to a better medication management, the amount of hospital admissions and general practitioner visits can be decreased (Deloitte 2011). In numbers, this means benefits of around AU$ 10.2 billion (Deloitte 2011). The more effective management of medication can be reached, because the PCEHR system can make the access to patients' health data possible and therefore can supply the healthcare providers with valuable information at the moment of prescribing, independent of the place and point in time (Deloitte 2011). In this way, it is possible to diminish situations of prescribing wrong or inadequate medicine as well as adverse drug events (Deloitte 2011). Secondly, it is expected that an enhanced continuity of healthcare can be achieved, which leads to benefits of approximately AU$ 1.3 billion (Deloitte 2011). The reason is that through the PCEHR system, the health information exchange across the healthcare sector (e.g. between providers as well as between providers and patients) can be improved and therefore healthcare delivery will become more effective and efficient (Deloitte 2011). As can be seen, the expected benefits achieved through the more effective management of medication are significant higher than the expected benefits obtained through the enhanced continuity of healthcare.

Based on all these facts, it can be concluded that Australia's national e-health solution was launched on time in the sense that people can register for the PCEHR system. However, the PCEHR system still needs further work as the rollout needs to be finished and personal health information of patients needs to be added to the PCEHR system. As has been shown, personal health information is essential for the PCEHR system in order to achieve the estimated net direct benefits. It is interesting to follow the further development in the next years. Especially the acceptance of the PCEHR by users of the Australian healthcare system is essential to follow as well as how the healthcare providers and healthcare organizations will accept and deal with the PCEHR system. Another point to focus is how the PCEHR system will work with existing software and existing systems. It will be also interesting to see in which amount the forecasted net direct benefits can actually be reached.

2.2.3.4 Data Protection, Data Security and Privacy

As section 2.2.3.2 has already mentioned, a quantitative survey had shown that people are primarily concerned about data security and privacy issues in the context of the PCEHR system. Therefore, it is very important for Australia that the PCEHR system ensures appropriate data protection, data security and privacy, because without appropriate trust in this PCEHR system, people are reluctant to participate and consequently the PCEHR system eventually fails (Department of Health and Ageing Australia 2011a; Department of Health and Ageing Australia 2011b; NEHTA 2011b; Royal Australian College of General Practitioners 2012). In the following it is shown, how Australia considers these issues in the context of e-health. It is important to note that the laws themselves are not cited in this thesis.

Privacy laws on the country, state and territory level guarantee the protection of personal health information in Australia (Department of Health and Ageing Australia 2011a; Department of Health and Ageing Australia 2011b; NEHTA 2011b; NEHTA 2012a; NEHTA 2012b). The fundamental Australian law for regulating privacy issues is the Privacy Act 1988, which includes information privacy principles (Department of Health and Ageing Australia 2011a; Department of Health and Ageing Australia 2011b; NEHTA 2012a; NEHTA 2012b). In detail, these principles regulate e.g. how organizations have to deal with the collection, solicitation, storage, security, usage and disclosure of personal information (Department of Health and Ageing Australia 2011a; NEHTA 2012a; NEHTA 2012b). Furthermore, the Privacy Act 1988 strengthens also the rights of individuals as it allows them to have access to their stored information and/or request alterations (Department of Health and Ageing Australia 2011a; NEHTA 2012a; NEHTA 2012b). Australia requires from all service providers of healthcare that they consider and follow this law and its information privacy principles (NEHTA 2012a; NEHTA 2012b).

In addition, especially for the new PCEHR system, the Personally Controlled Electronic Health Records Act 2012 was passed (NEHTA 2012a; NEHTA 2012b). This Act has the goal to permit the creation and action of the PCEHR system. Further, this Act mentions civil penalty provisions, which apply, if health information stored in a PCEHR is collected, used or disclosed without authorization (NEHTA 2012a; NEHTA 2012b). Beside legislation, providers of healthcare need also to follow the required ethical and professional codes as well as standards (NEHTA 2012a; NEHTA 2012b).

Another fundamental aspect to ensure data protection, data security and privacy is the National eHealth Security and Access Framework (NESAF) (NEHTA 2011b; NEHTA 2012a;

NEHTA 2012b; Royal Australian College of General Practitioners 2012). The NESAF is a risk-based approach that can be adapted to different practices and healthcare organizations, independent of e.g. their type, dimension or as well complexity (NEHTA 2011b; NEHTA 2012b; Royal Australian College of General Practitioners 2012). In this way, it supports healthcare providers and organizations to align their environment and security practices to the unfamiliar PCEHR environment (NEHTA 2011b; NEHTA 2012a; NEHTA 2012b; Royal Australian College of General Practitioners 2012). In detail, it supplies indispensible tools, information, etc., for healthcare providers and organizations, which they can use for their risk assessment and detection of proper access and security controls (NEHTA 2011b; NEHTA 2012a; NEHTA 2012b; Royal Australian College of General Practitioners 2012). The NESAF implementation process is illustrated in figure 10.
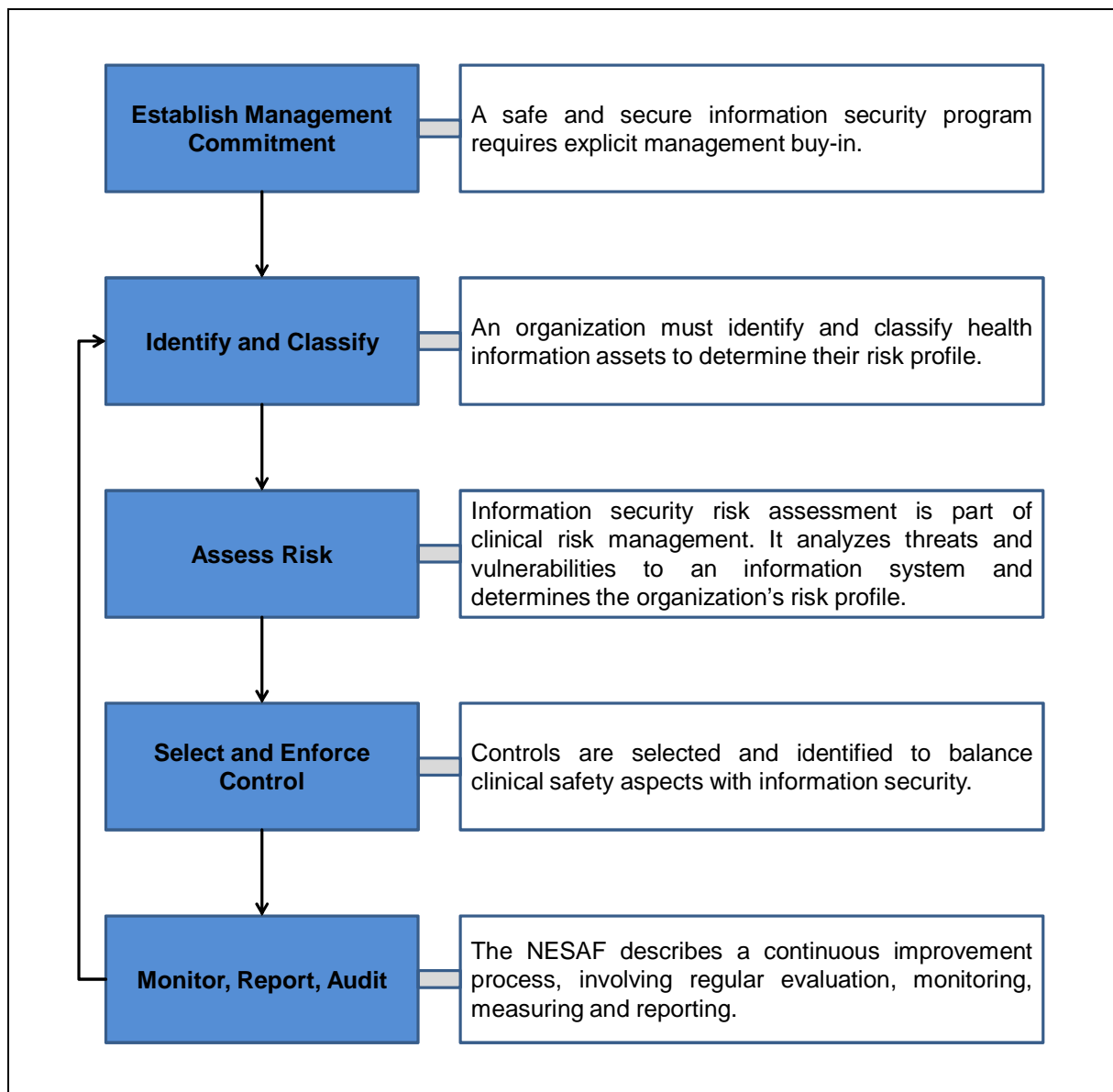
Figure 10: NESAF implementation process (adapted from NEHTA 2011b; NEHTA 2012b)

As figure 10 shows, improvements must be made continuously and therefore this process is depicted as an iterative process (NEHTA 2011b; NEHTA 2012b). In this way, health information's confidentiality, its integrity and its availability can be retained (Department of Health and Ageing Australia 2011a; NEHTA 2011b; NEHTA 2012b; Royal Australian College of General Practitioners 2012).

In addition, the NESAF suggests healthcare providers and healthcare organizations numerous security safeguards, which are (Department of Health and Ageing Australia 2011a; NEHTA 2012a):

- Use audit trails to get a proof, which persons had access to the respective PCEHR and its health information (Department of Health and Ageing Australia 2012b).

- Make sure that only people with proper authorization have health information access.

- Make backups in order to allow the recovery of data.

- Ensure that the health information exchange among healthcare organizations is secure.

Figure 11 illustrates the benefits, which can be achieved through the application of the NESAF. It can be seen that through the use of the NESAF trust in e-health along healthcare players increases, which is as mentioned in the beginning essential for the success of the PCEHR system (NEHTA 2011b; NEHTA 2012a; NEHTA 2012b; Royal Australian College of General Practitioners 2012). This increase in trust is also due to the fact that the NESAF is applied locally (Royal Australian College of General Practitioners 2012).
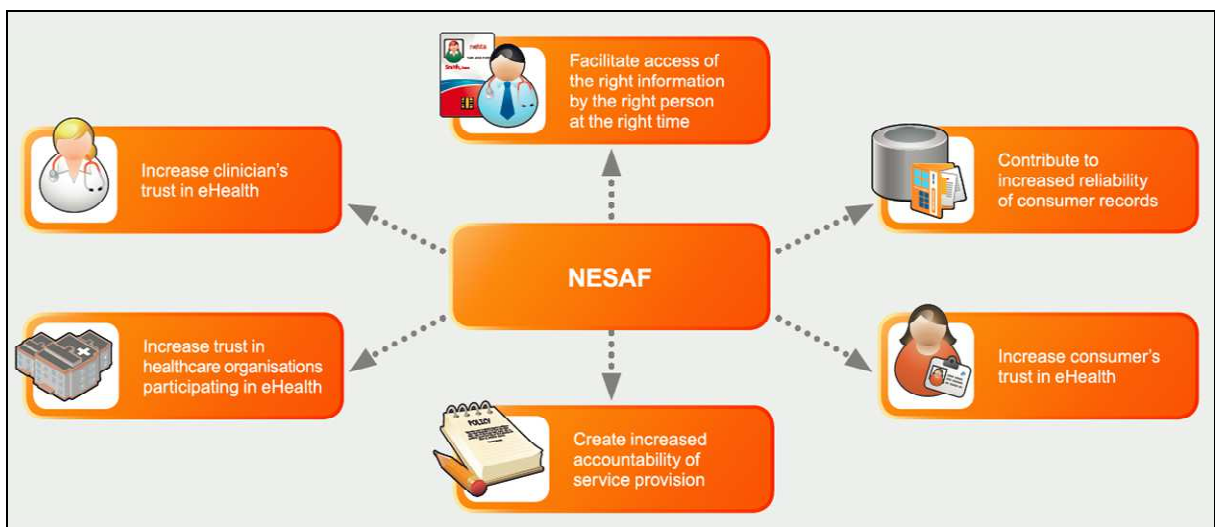
Figure 11: Benefits of the NESAF (NEHTA 2012b)

Overall, the NESAF is a very important framework for Australia, as the new PCEHR system deals with sensitive health information and therefore requests the awareness of data protection, data security and privacy. However, it is important to note that the NESAF acts for general practices only as a foundation, because the Royal Australian College of General Practitioners (RACGP) has developed for general practices the Computer and Information Security Standards (CISS) (NEHTA 2012b; Royal Australian College of General Practitioners 2012). Nevertheless, the NESAF and the CISS can work concurrently, as this issue was considered during the development of the CISS (NEHTA 2012b; Royal Australian College of General Practitioners 2012). Furthermore, the NESAF and the CISS are based on the same ISO standards and they are focused on the same purpose, namely the implementation of secure security measures in order to protect the health information in the PCEHR system (NEHTA 2012b; Royal Australian College of General Practitioners 2012). If the general practices apply the CISS appropriately, they can be sure that their policies, processes and security measures meet the terms of the NESAF respectively its higher level requirements (NEHTA 2012b; Royal Australian College of General Practitioners 2012).

Beside legislation, NESAF and CISS, individuals can also help to increase data protection, security and privacy. It is important that they use secure passwords, be careful with their information sharing on social media websites and use only secure computers for the login to the PCEHR (Department of Health and Ageing Australia 2012b; NEHTA 2012a).

In addition, further technical solutions like encryption techniques or secure logins are necessary and therefore applied (Department of Health and Ageing Australia 2011a; NEHTA 2011b; Department of Health and Ageing Australia 2012b). They are very important in order to make the PCEHR system safety and to protect the records against unauthorized access of people (Department of Health and Ageing Australia 2011a; NEHTA 2011b; Department of Health and Ageing Australia 2012b).

Because the DOHA has realized that data protection, security and privacy are very important, they had conducted a privacy impact assessment in the context of the PCEHR (Department of Health and Ageing Australia 2011b). The resulting report includes several privacy risks (Department of Health and Ageing Australia 2011b). These identified privacy risks are e.g.: by using compulsory data fields for demographic data or identity issues several collection risks occur; showing extraneous health information to authorized people or display information like patient's home address involve risks of disclosure; and misuse of the PCEHR leads to usage and disclosure risks (Department of Health and Ageing Australia 2011b).

Specific recommendations for these risks are made and it is important to follow, if all risks can be avoided in the end (Department of Health and Ageing Australia 2011b).

In summary, data protection, security and privacy are essential issues for the success of the PCEHR system. Australia has several laws available and has several steps undertaken to ensure these issues. However, it is important to note that the success of ensuring these issues also depends on how the processes, the technologies as well as the people are interacting at the end, because it is a necessity that all three are working together (NEHTA 2012b). It will be interesting to follow how the PCEHR system works and to which level data protection, security and privacy can be ensured in this context.

2.2.3.5 Critical Aspects of Telematics Infrastructure

In order to enable the PCEHR system, it is necessary for Australia to have an underlying telematics infrastructure. This section outlines the information flows of the PCEHR system, presents the telematics infrastructure of the PCEHR system and explains its key components. Figure 12 shows how the information flows among the PCEHR system and its users occur.
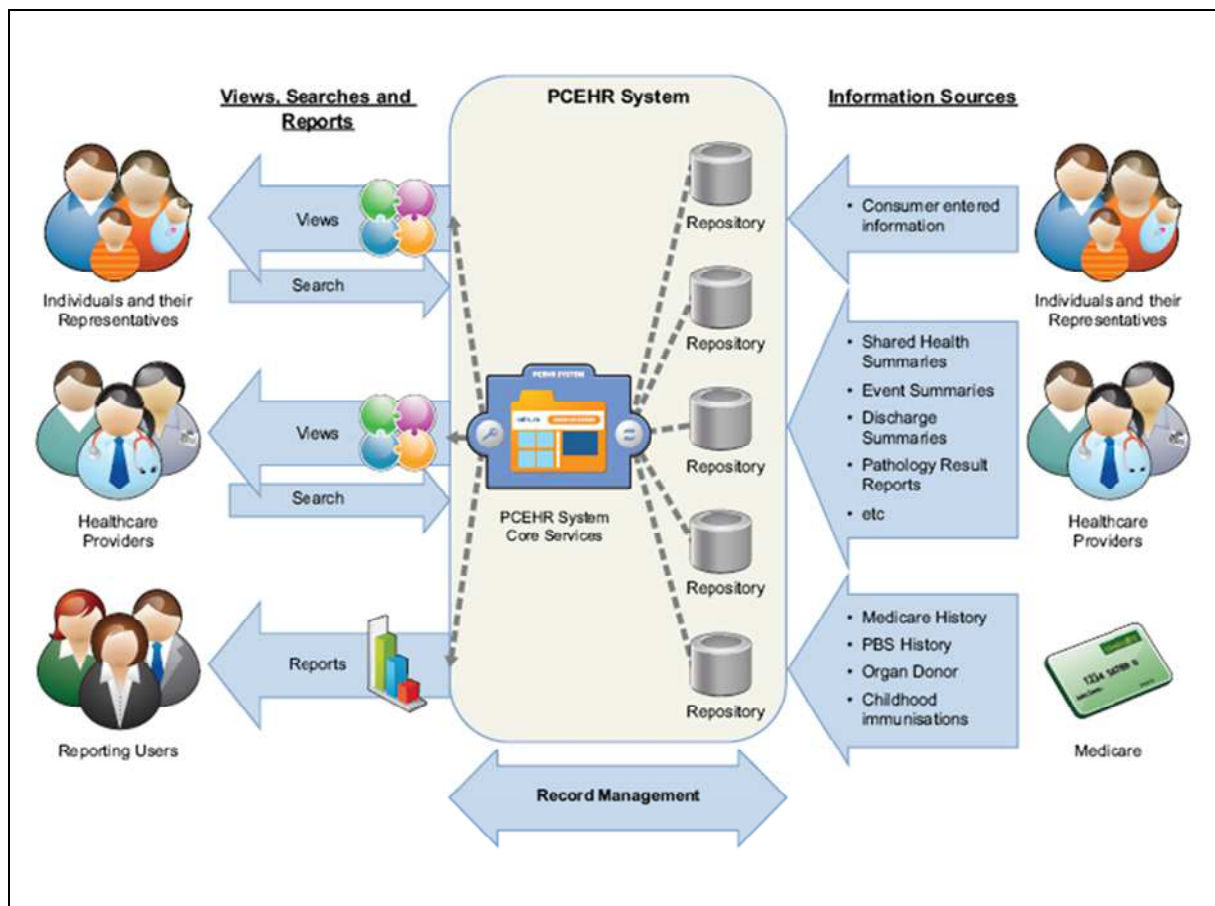
Figure 12: PCEHR system information flows (NEHTA 2011b)

On the left, there are the people who have access authorization and who want to utilize the PCEHR system and its core services (Department of Health and Ageing Australia 2011a; NEHTA 2011b). This group of people includes individuals/representatives, healthcare providers and reporting users (Department of Health and Ageing Australia 2011a; NEHTA 2011b). There exist several reasons to use the PCEHR system and its core services: firstly, people such as healthcare providers can search for a specific PCEHR plus a step further for a specific clinical document and can view the health information; secondly, reporting users can get different reports (Department of Health and Ageing Australia 2011a; NEHTA 2011b).

On the right, there are the people who have the right and need to upload the information to the individual's PCEHR (Department of Health and Ageing Australia 2011a; NEHTA 2011b). This group of people includes individuals/representatives, healthcare providers and Medicare (Department of Health and Ageing Australia 2011a; NEHTA 2011b). The information provided by an individual/representative can be notes or a consumer entered health summary including allergies or details about medication (Department of Health and Ageing Australia 2011a; NEHTA 2011b). Healthcare providers can supply shared health summaries including adverse reactions, allergies or information about the medical history of a patient (Department of Health and Ageing Australia 2011a; NEHTA 2011b). In addition, healthcare providers can provide event summaries, discharge summaries and further clinical documents respectively health information (Department of Health and Ageing Australia 2011a; NEHTA 2011b). Medicare can supply e.g. information about dispensed medicine, which are covered through the Pharmaceutical Benefits Scheme (PBS) or details about the individual's organ donation decision (Department of Health and Ageing Australia 2011a; NEHTA 2011b). The information is stored in secure repositories, which are located within the PCEHR system (Department of Health and Ageing Australia 2011a; NEHTA 2011b).

The following figure 13 illustrates the underlying telematics infrastructure of the PCEHR system and highlights its different components. As already known, the users of the PCEHR system are e.g. individuals/representatives or healthcare providers (Department of Health and Ageing Australia 2011a; NEHTA 2011b). The access can be realized by several user systems as well as access channels (Department of Health and Ageing Australia 2011a; NEHTA 2011b). Examples for user systems are clinical systems and independently provided and operated conformant portals for consumers (Department of Health and Ageing Australia 2011a; NEHTA 2011b). Examples for access channels are a call centre, a nationally provided and operated consumer portal, a nationally provided and operated provider portal, a report portal and a business-to-business (B2B) gateway, which permit several decentralized systems

(e.g. clinical systems) to have access to the PCEHR system (Department of Health and Ageing Australia 2011a; NEHTA 2011b).
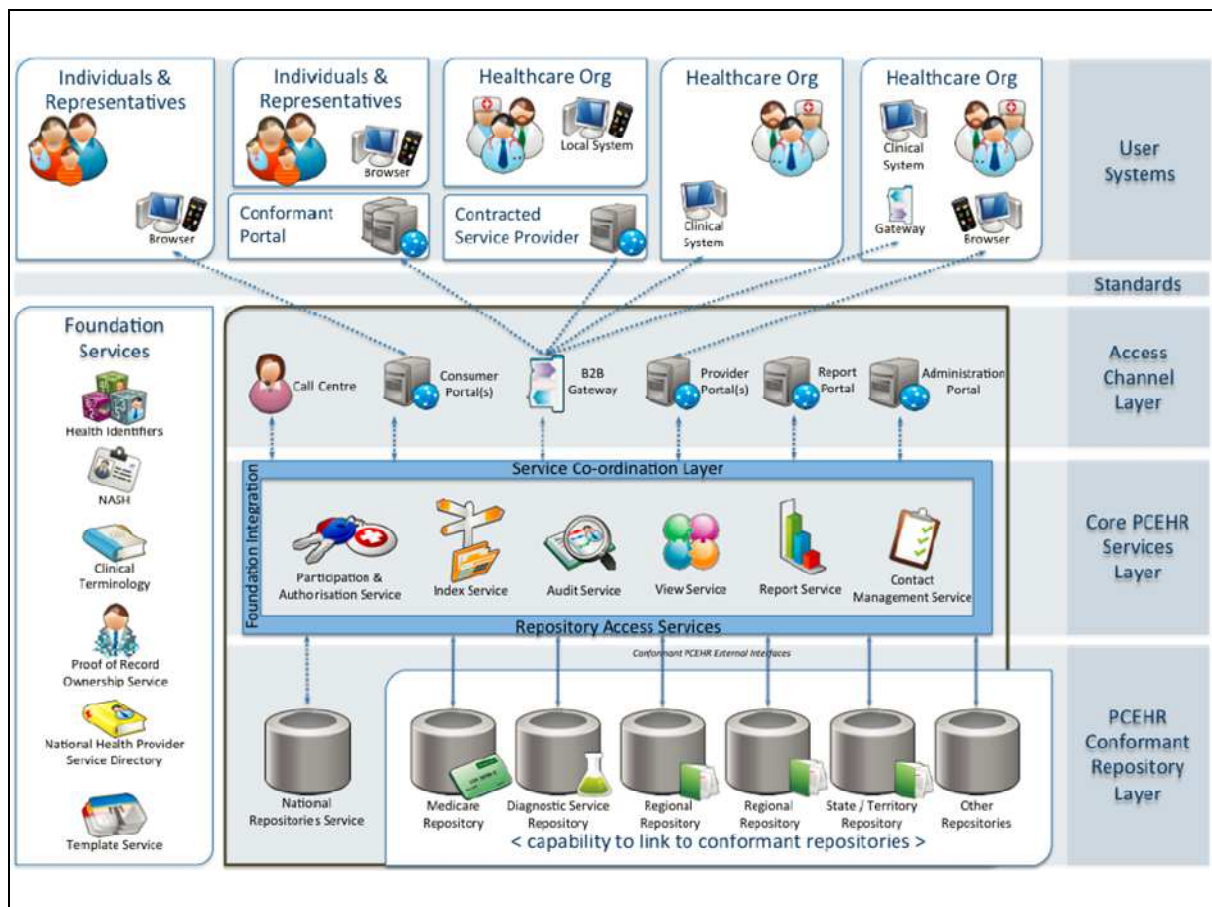
Figure 13: PCEHR system components (Department of Health and Ageing Australia 2011a)

As figure 13 also shows, there are several foundation services like the HI Service, the template service or the National Authentication Service for Health (NASH) available (Department of Health and Ageing Australia 2011a; NEHTA 2011b). The NASH is a nationwide service, which deals with digital credentials and which is intended especially for the healthcare organizations as well as providers (Department of Health and Ageing Australia 2011a; NEHTA 2011b).

Further, figure 13 exemplifies the available core services of the PCEHR system, which are explained in the following (Department of Health and Ageing Australia 2011a):

- The service co-ordination layer is necessary as it helps for the orchestration of the core services.

- The participation and authorization service manages, among others, the PCEHR registration of individuals and the access controls.

- The index service is primarily utilized to relate PCEHR participants with their previously stored clinical documents. For every clinical document, metadata are stored.

- The audit service logs all accesses to the PCEHR system and its underlying conformant repositories. In this way, it is possible to identify the person, his/her level of authorization, his/her requested data and the time of his/her data access.

- The view service permits diverse people (e.g. individuals and healthcare providers) to get several views on the information stored in a PCEHR. However, in which way the information is combined depends on the particular user group and its needs.

- The report service supports the monitoring of the PCEHR system. Thereby, the report service supplies various reports like e.g. operational reports or usage reports.

- The contact management service is an essential service as it deals with complaints and requests, which participants have made. For each complaint or request, a special identifier is created, which is then used through the complete problem solving process.

- The repository access layer is necessary for enabling and handling the access to the repositories in the background. The repositories consist of the national repositories service on the one hand and some other conformant repositories on the other hand.

The national repositories service includes multiple repositories, which are operated nationally (Department of Health and Ageing Australia 2011a). Furthermore, this service is responsible "that there is capacity to store a minimum critical set of health information about participating individuals" (Department of Health and Ageing Australia 2011a, p. 100).

In summary, this section has given a detailed view about the information flows of the PCEHR system. Further, the telematics infrastructure and its key components, which are necessary in order to bring the PCEHR system to work, were presented. A statement and evaluation about the Australian national e-health solution is given in section 2.2.5, where the Australian and the German national e-health solutions are compared/contrasted with each other.

2.2.4 E-Health in Germany

This section explains the German national e-health solution. This solution is based on a smart card solution, namely the electronic health card (eHC). Most of the references in this section

are only available in German and therefore requests translations. Further, it should be noted that a large amount of the content presented in this section 2.2.4 is already published by the researcher (see Zwicker et al. 2011; Zwicker et al. 2012a; Zwicker et al. 2012b; Zwicker et al. 2012c; Muhammad et al. 2013a; Zwicker et al. 2014).

2.2.4.1 Leading National E-Health Institution/Organization

The Gesellschaft für Telematikanwendungen der Gesundheitskarte mbH (gematik), in English Society for Telematics Applications of the Health Card, is the German equivalent to Australia's NEHTA. The gematik was established on 11th January 2005 (gematik 2010a).

The associates of the gematik are the head organizations of healthcare providers (including doctors, dentists, pharmacists and hospitals) and payers (gematik 2010b). It is important to note that hospitals are allocated to providers instead of organizations at this point. At the meeting of the associates, the National Association of Statutory Health Insurance Funds, in German GKV-Spitzenverband, holds 50 % of the voting rights and has therefore the most influence on decision making (gematik 2010c). The reason is that the other head organizations have to share the other 50 % among themselves (gematik 2010c).

The gematik has several duties. Firstly, the gematik is responsible for the implementation of the e-health card (gematik 2010a). Secondly, the gematik is in charge of the underlying telematics infrastructure including implementation, operation and further development (gematik 2010d). However, the operative part of the management is realized by partners of the industry (gematik 2010d). Thirdly, the gematik undertakes the approval procedure of services, processes and components (gematik 2010e). In this way, the gematik ensures that these are compliant with the specifications and the requirements given (gematik 2010e).

2.2.4.2 First Stage

In Germany, the national e-health solution is based on a smart card solution, namely the electronic health card (eHC) (gematik 2008a; gematik 2010f). This section gives an overview of the initial implementation plan of this eHC.

In general, the initial implementation is based on four successive steps (BKK Wirtschaft und Finanzen 2013). Each step brings new e-health functions along and therefore the initial implementation plan can be seen as an ongoing implementation process (BKK Wirtschaft und Finanzen 2013). The first two steps encompass the administrative functions of the eHC,

which are compulsory for all eHC holders (gematik 2008a; BKK Wirtschaft und Finanzen 2013). The other two steps include the medical functions, which are optional for all eHC owners (gematik 2008a; BKK Wirtschaft und Finanzen 2013).

The following figure 14 illustrates the eHC implementation plan and its four steps. In addition, this figure shows the front view of an eHC. The eHC includes a photo of the enrollee, which protects against misuse (gematik 2010g; gematik 2012). Further, a lifelong valid health insurance number on the eHC helps for the clear assignment between enrollee and treatment information (gematik 2010g).
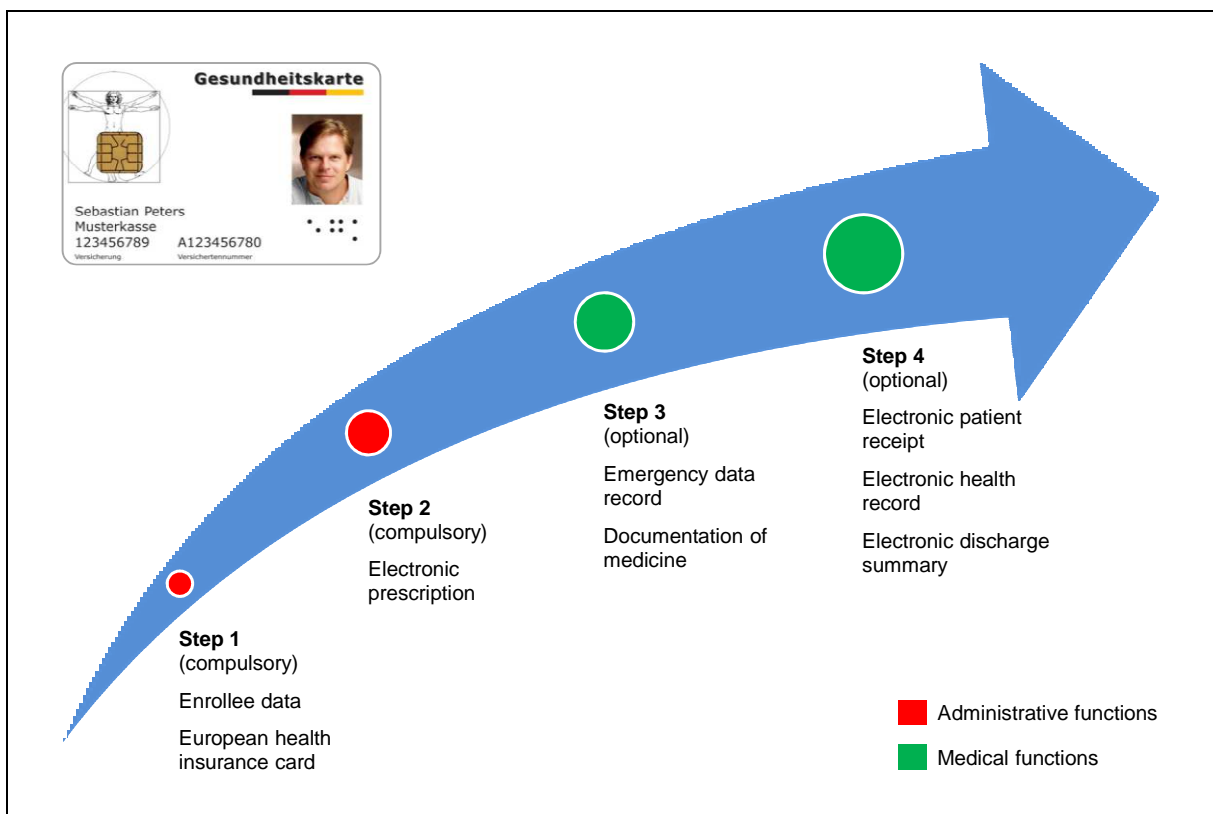
Figure 14: Initial implementation plan of the eHC (adapted from Krüger-Brand 2005; gematik 2010h; Zwicker et al. 2011)
[The original reference for this figure is the German Federal Ministry of Health. However, because these steps are not valid anymore (see section 2.2.4.3), this figure is not available any longer on the Ministry's website]

Step 1 of the initial implementation plan focuses on personal enrollee data, which are stored on the eHC right from the start (gematik 2010g; gematik 2011; BKK Wirtschaft und Finanzen 2013). This includes the enrollee's name, date of birth and address (gematik 2010g; gematik 2011). Further, the insurance status and further information like e.g. the need of copayments can be stored (gematik 2010g; gematik 2011). This function was also available on the former health insurance cards (gematik 2010g; gematik 2011). In addition, step 1 involves the European Health Insurance Card (EHIC), which is imprinted on the reverse of the eHC

(gematik 2010i; gematik 2011; BKK Wirtschaft und Finanzen 2013). The EHIC allows owners to get "access to medically necessary, state-provided healthcare during a temporary stay in any of the 28 EU countries, Iceland, Lichtenstein, Norway and Switzerland, under the same conditions and at the same cost (free in some countries) as people insured in that country" (European Commission 2013). In this way, the old forms are no longer necessary (gematik 2010i). The EHIC was already available on some of the former health insurance cards, depending on the health insurance company (gematik 2010i).

Step 2 of the initial implementation plan targets the electronic prescription (e-prescription), which is compulsory and thus has to be used by patients and healthcare providers (Schweim 2007; BKK Wirtschaft und Finanzen 2013). Hence, the around 700 million paper-based prescriptions, which are used annually, can be replaced (Schweim 2007). Further, the current media disruptions in the complete prescription process can be avoided (Schweim 2007).

Step 3 of the initial implementation plan encompasses the first medical functions, which are the emergency data record and the documentation of medicine (BKK Wirtschaft und Finanzen 2013). These e-health functions are optional for enrollees and therefore sensitive health information of a patient can only be stored and accessed with his/her consent (gematik 2008a; BKK Wirtschaft und Finanzen 2013; gematik 2010j). The emergency data record includes details about allergies, chronic diseases or drug intolerances, which are stored on the eHC directly and which can be read by the emergency doctor in case of emergency (gematik 2011). However, it should be noted that the emergency doctor can read the emergency data without the input of the patient's PIN, as this cannot be guaranteed through an injured patient (gematik 2011). Due to the documentation of medicine, the risk of interdependencies among different drugs can be reduced (gematik 2011).

Step 4 is the last step of the initial implementation plan and includes the implementation of three medical functions: the electronic patient receipt, the electronic health record (EHR) and the electronic discharge summary (BKK Wirtschaft und Finanzen 2013). In particular, the EHR needs to be highlighted here. If the patient gives his/her consent, it is possible to store the complete health data of a patient in his/her EHR (gematik 2011). Examples are laboratory results, former surgery reports and X-rays (gematik 2011). In this way, it is possible for e.g. a doctor to get direct access to the patient's former medical history – consent of the patient assumed –, irrelevant where and when the former treatment was conducted and the data were collected (GVG 2004). Consequently, it is expected that the EHR reduces delays and redundant examinations, but also enhance quality and efficiency of medical care (GVG 2004).

2.2.4.3 Second Stage

This section outlines the recent situation of the eHC implementation in Germany. However, before more details are presented, two important facts need to be noted in advance. Firstly, private health insurance companies and thus their enrollees have suspended their participation in the eHC implementation (Krüger-Brand 2009a). The reason for their decision is that at the moment doctors, dentists, pharmacies and even hospitals are not legally obligated to accept and use the eHC of their enrollees (Krüger-Brand 2009a). Therefore, the high costs cannot be justified unless the law is amended (Krüger-Brand 2009a). As a consequence, this means that the eHC implementation is currently just focused on people with statutory health insurance, because for them the legal basis exists (Krüger-Brand 2009a; gematik 2012). Nevertheless, this represents around 90 % of the population (BMG 2013). Secondly, the initial implementation plan, as presented in section 2.2.4.2, is scrapped. The reasons and the changes are presented in detail in the following.

The implementation start of the eHC was actually scheduled for the year 2006 (Krüger-Brand 2005; Schellhase 2011). However, several problems had lead to a delay of around five years (Schellhase 2011). One problem were the numerous debates among different healthcare stakeholders (Schellhase 2011). For example, disagreements existed regarding security, costs and functionality (Schellhase 2011). Further, discussions were held about the correct strategy and timing (Schellhase 2011).

Furthermore, an interim report was published, which gives details about the field test (release 1) in seven test regions (gematik 2008b). Some facts are presented in the following. The field test involved 11 hospitals, 115 pharmacies as well as 188 physicians in private practice (gematik 2008b). In addition, 60,281 enrollees participated. The report shows that tests are very important (gematik 2008b). It also mentions that more work needs to be done in order to align the primary systems of the healthcare providers and hospitals – an example is a hospital information system – to their day-to-day operations (gematik 2008b). In addition, it is stated that healthcare providers currently see performance problems, especially in the context of e-prescriptions and emergency data records (gematik 2008b). These functions change the existing business processes and their creation requires a lot of effort by providers (gematik 2008b). Therefore, they do not experience an improvement for their daily business through the implementation of the eHC so far (gematik 2008b). However, they have signaled that e-health functions like electronic discharge summaries might change their acceptance, as they have a direct benefit to them (gematik 2008b). Moreover, the importance of data protection and data security is pointed out and that these issues must be considered carefully, precisely

and continuously (gematik 2008b). In this context, especially the personal identification number (PIN) of the enrollee is mentioned, which is necessary for the optional e-health functions (gematik 2008b). While this PIN is an important security measure, the test results have shown that the PIN handling must be improved, because the current handling affects the acceptance negatively (gematik 2008b). Overall, this interim report has given details about the test results including problems, lessons learned and appropriate improvement measures, which helps for the following proceedings (gematik 2008b). However, it is important to note that further test results must be considered, before more conclusive statements can be made. Further, it should be noticed that the procedure regarding the enrollee's PIN and the healthcare provider's PIN is explained in detail in section 2.2.4.4 and 2.2.4.5, while descriptions of the technical components necessary in the context of the telematics infrastructure are presented in section 2.2.4.5.

Another problem was that the e-prescription test was unsatisfactory (Krüger-Brand 2009b). Thus, this e-health function is shelved until further notice (Krüger-Brand 2009b). Hence, this thesis does not consider the e-prescription in further statements, unless it is specifically stated.

These presented facts have certainly contributed to the difference among the current implementation plan and the initial implementation plan. How the current implementation plan looks like and which e-health functions are intended, is explained in the following.

On 1st October 2011, the basis rollout of the eHC has started (gematik 2010k; Schellhase 2011; gematik 2012). Since that time, the statutory health insurance companies have begun to successively send the eHCs to their enrollees (gematik 2010k; Schellhase 2011; gematik 2012). The enrollee's photo as well as the lifelong valid health insurance number are on the eHC as planned previously (gematik 2010g; gematik 2012). Further, the hospitals, physicians, dentists, etc., were equipped with the new card terminals since 2011 (gematik 2010l).

The e-health functions are still separated as compulsory and optional functions, as this is regulated by law (gematik 2010j). Further, the gematik classifies the e-health functions as functions, which are available and functions, which are in preparation (gematik 2010k; gematik 2010m). Through the basis rollout, the available functions are the enrollee data and the EHIC on the reverse of the eHC (gematik 2010k). It should be noted that the administrative data are already stored on the eHC, before the eHC is forwarded to the enrollees (gematik 2010l). As can be seen, these available functions are equivalent to step 1 of the initial implementation plan and are already known from the old health insurance cards (gematik 2010g; gematik 2010i; gematik 2010k; gematik 2011; gematik 2012).

The e-health functions, which are currently in preparation, are implemented in two steps (gematik 2010m). It should be noted that all these functions require the connection to the telematics infrastructure and therefore these steps are called online rollout step 1 and online rollout step 2 (gematik 2010m). The first step of the online rollout enables the possibility to check and update enrollee data, which are stored on the eHC, automatically online (gematik 2010m). Thereby, the enrollee data on the eHC are synchronized with the latest enrollee data, which are provided by the system of the competent health insurance company (gematik 2010m). In this way, it is possible to improve the current process vastly, as changes in the enrollee data do not require the delivery of a new card anymore (gematik 2010m). The second step of the online rollout brings several medical functions along (gematik 2010m):

- Management of emergency data: deals with the optional storage of data like allergies, implants, emergency contact, which can be read by the emergency doctor without the help of the patient.

- Documentation of medicine: patients have the choice, if for example medication data or drug prescribing data should be recorded or not. In this way, primarily doctors and pharmacists can consider the drugs, which a patient uses at the moment, in the current therapy. It is important to note that the gematik calls this e-health function currently Arzneimitteltherapiesicherheitsprüfung, which means in English the check of the safety of the drug therapy.

- Secure communication among healthcare providers: e.g. the electronic discharge summary allows the secure, legally binding and compatible exchange of health information among medical practitioners.

- Electronic case file: this e-health function allows different healthcare providers, which are involved in the patient's treatment belonging to the same case, to contribute to the documentation of the health data. This is essential, because the healthcare providers are responsible together for the treatment of the specific case, but they stay at different locations/facilities.

In summary, several major differences between the initial implementation plan and the current implementation plan exist. The implementation of the eHC has started with a delay of five years and includes only enrollees with statutory health insurance. Step 1 of the initial implementation plan is realized with the basis rollout of the eHC. Step 2 of the initial implementation plan is discarded, because the e-prescription is shelved. Step 3 of the initial

implementation plan will be realized with the online rollout step 2. Step 4 of the initial implementation plan will be slightly executed. The electronic discharge summary is planned with the online rollout step 2; however, the further proceeding regarding the electronic patient receipt and the electronic health record is unclear at the moment. With the electronic case file (online rollout step 2), which is a lower version of an electronic health record, a first amends is on the way. The functionality included in the online rollout step 1 was not considered in the initial implementation plan. In the end, it can be stated that despite all the care taken, the eHC is not able to offer a medical function so far.

2.2.4.4 Data Protection, Data Security and Privacy

Health data of a patient are a sensitive topic. Therefore, it is essential for the German national e-health solution that data protection, data security and privacy are appropriately ensured. In the following it is shown, how Germany considers these issues. It is important to note that the laws themselves are not cited in this thesis.

The fundamental law for the eHC and its implementation is Section 291a SGB V (Code of Social Law, Volume Five). In this law it is regulated, which functions need to be supported by the eHC. The law also mentions precise rules regarding the collection, processing and usage of health data. Because the misuse of health data is a bad offense, this law is supported by two further laws, which are Section 307 SGB V (Code of Social Law, Volume Five) and Section 307b SGB V (Code of Social Law, Volume Five). While the former law mentions details about provisions concerning fines, the latter law includes details about penal provisions.

The gematik is responsible for the implementation of the eHC and the telematics infrastructure (gematik 2010a; gematik 2010d; gematik 2012). Further, the gematik has also to make sure, that the rights of each enrollee are protected and that the telematics infrastructure is secure and in accord with the given laws (gematik 2012). Thus, the gematik also works closely together with the German Federal Office for Information Security and the German Federal Commissioner for Data Protection and Freedom of Information (gematik 2012).

Consequently, several security measures are available in order to guarantee data protection, data security and privacy in Germany. In this context, the gematik has developed an overview. The details are presented in the following; however, they are adapted and further details from the gematik and Section 291a SGB V (Code of Social Law, Volume Five) are complemented. The essential security measures are (gematik 2012):

- The utmost security standards are applied to make the eHC secure.

- The services, components, etc., need to pass the approval procedure of the gematik, before they can be used within the telematics infrastructure (gematik 2010e).

- Encryption protects the health data against unauthorized access (gematik 2008a).

- The enrollee is the only person, who has the control over his/her health data (gematik 2008a). This means that he/she decides alone, which optional e-health functions he/she wants to use (gematik 2008a). Further, the enrollee makes the decision, which health data are stored, processed or used (gematik 2008a). In addition, only the enrollee decides which people have access to his/her health data, including when and to which scale (gematik 2008a). In the end, the enrollee can also reject all medical functions.

- Relating to the telematics infrastructure and optional e-health functions, a combination of the two-card-principle and two PINs is used (gematik 2008a). This means that the access to these patient's health data requires two cards and two PINs (gematik 2008a). The first card is the eHC of the patient (gematik 2008a). The healthcare provider like a doctor or a pharmacist has the second card, which is the health professional card (HPC) (gematik 2008a). Both cards need to be inserted into a card terminal and the patient and healthcare provider have to enter the particular PIN (gematik 2008a). Through the eHC and the entered PIN of the patient it is ensured that the healthcare provider has the always necessary consent of the patient, before he/she can access the health data (gematik 2008a). As already mentioned, an exception is the emergency data record on the eHC, because in emergencies, the PIN of the patient is not required for the emergency doctor to get read access to the emergency data. However, the patient had previously agreed to the creation of the emergency data record and this proceeding. Section 2.2.4.5 gives further details about the interaction between two-card-principle, PINs and telematics infrastructure. It should be noted that for specific cases or requirements, there exist alternatives (professional cards) or supplements (security module cards) to the HPC, which are not part of this thesis (gematik 2013).

- The PIN can be chosen and changed by the patient (gematik 2008a).

- On the eHC, the latest fifty accesses to the patient data are logged (gematik 2008a).

In summary, it can be seen, that Germany and especially the gematik is aware of data protection, data security and privacy in the context of the eHC. Several security measures are

available. Furthermore, it is the enrollee/patient, who has the control over his/her health data. The enrollee/patient, who is still worried, is also able to use the eHC without medical functions. However, it must be stated clearly that the eHC currently involves no medical function and therefore it is not possible to evaluate data protection, data security and privacy in a real-life context. It will be interesting to follow how the eHC and its e-health functions work in the future and which level of data protection, security and privacy can be actually ensured in this context.

2.2.4.5 Critical Aspects of Telematics Infrastructure

This section presents details about the telematics infrastructure, which is the backbone of the eHC. In addition, e-kiosks are focused, because they can support an enrollee in the exercise of the control over his/her health data. More specifically, it is presented, how e-kiosk systems can be adjusted to the requirements of the seriously disabled people and the illiterates, because this is essential when looking on the equity issue.

Telematics Infrastructure

The telematics infrastructure is very important, as it is the backbone of the eHC (gematik 2008a; gematik 2010n; Zwicker et al. 2011). The reason is that the different doctors, hospitals, health insurance companies, etc., have to be connected, before in particular the medical functions of the eHC can be used (gematik 2008a). Because primarily health data are transmitted via the telematics infrastructure, it is necessary to have an approach, which has a good performance and is secure, but also in accord to the given laws (gematik 2008a; gematik 2012). In order to realize the online rollout and its functions, which were presented in section 2.2.4.3, the telematics infrastructure must be ready for operation.

Several components are necessary, before health data can be transmitted via the telematics infrastructure (gematik 2008a). These components must be secure, compatible and interoperable (gematik 2010n). Firstly, there is the eHC of the patient and the HPC of the healthcare provider (gematik 2008a). Both cards are part of the so called two-card-principle (gematik 2008a). In this context, the PIN of the patient and the PIN of the healthcare provider are needed (gematik 2008a). Secondly, a specific card terminal is required, which is able to deal with the new eHC and the HPC (gematik 2008a). Thirdly, a computer system (inclusive a primary system) needs to be available in each healthcare facility (gematik 2008a). Fourthly, a tap-proof transport channel is required (gematik 2008a). Fifthly, a connector is needed, because it is the link between decentralized components like the eHC, HPC, card terminal and

computer system on the one hand and the central telematics infrastructure on the other hand (gematik 2008a). The structure of the connector is similar to a computer, which includes several security precautions (gematik 2008a). The connector makes sure that the health data are channeled securely into the telematics infrastructure (gematik 2008a). Because the connector is obvious an important component, as it allows the access to the telematics infrastructure, the gematik and the Federal Office for Information Security conduct extensive tests as well as a certification procedure (gematik 2008a). Finally, data centers for the storage of the data and a broker among connector and data centers are required (gematik 2008a).

In order to make the data secure, the hybrid encryption is applied (gematik 2008a). Hybrid encryption combines symmetric and asymmetric encryption (Schneier 1996). In the following figure 15 it is shown, how health data are encrypted and then prepared for transmission via the telematics infrastructure. In this example, it is assumed that the patient is at the doctor's office and the doctor wants to send the health data of the patient.
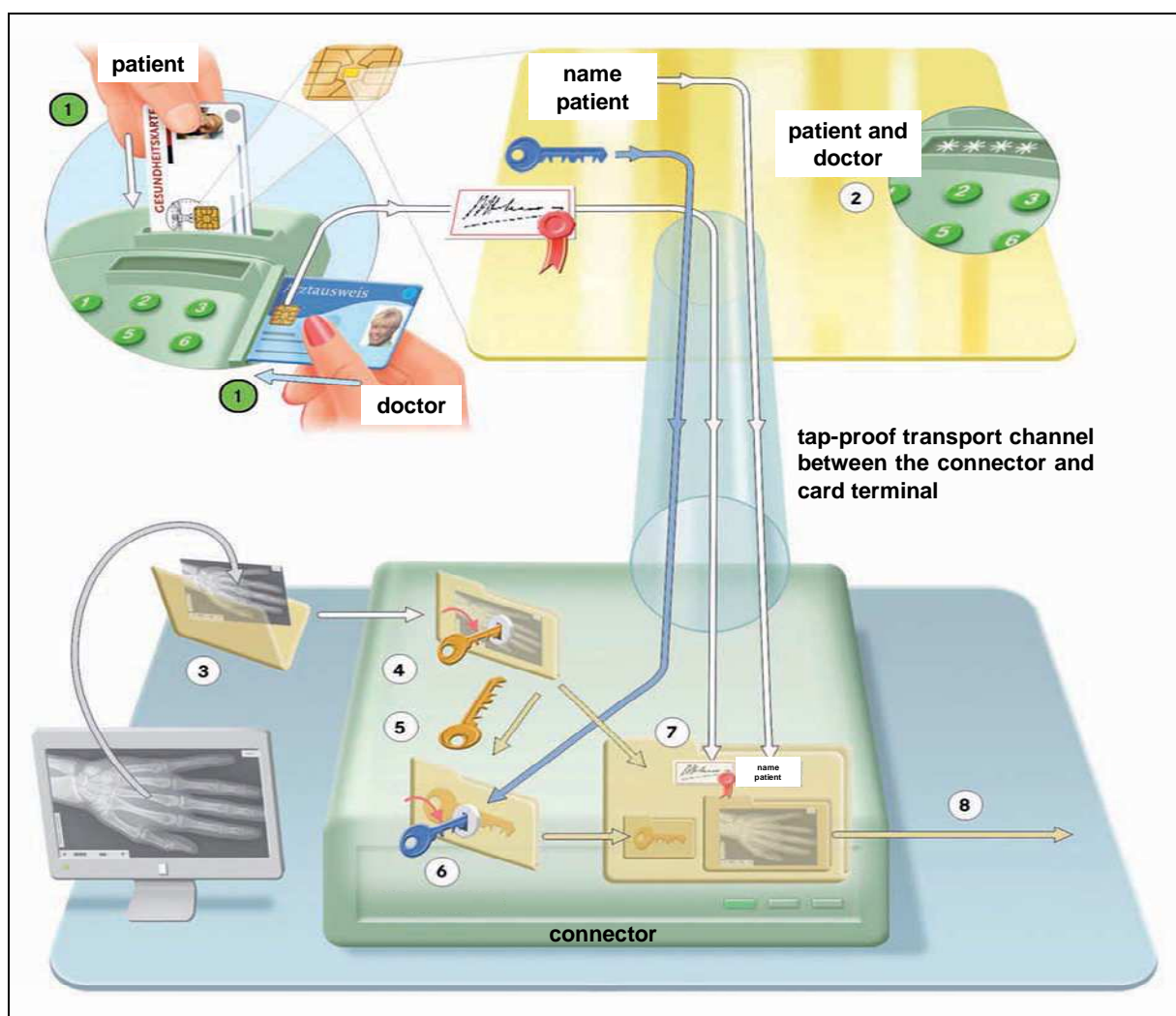
Figure 15: Health data encryption (adapted from gematik 2008a; Zwicker et al. 2011; Zwicker et al. 2012c)

Figure 15 shows following steps (gematik 2008a; Zwicker et al. 2011; Zwicker et al. 2012c):

❶,❷ Before the health data of a patient can be encrypted and then subsequently prepared for transmission via the telematics infrastructure, two steps need to be ensured in advance. Firstly, the patient has to insert his/her eHC and the doctor has to insert his/her HPC into the card terminal. Secondly, each actor has to enter the correct PIN. Only when both steps are processed correctly, the health data can be encrypted and then subsequently prepared for transmission via the telematics infrastructure.

❸ In this step, the health data of a patient are transmitted from the computer system of the doctor to the connector.

❹ The connector generates randomly a one-time secret key (symmetric key) and uses this key to encrypt symmetrically the health data of a patient.

❺,❻ The secret key (symmetric key) is in turn encrypted with the public key (asymmetric key) of the eHC holder. In this context it is important to note that the public key (asymmetric key) is retrieved from the microprocessor of the eHC.

❼ In the next step, the doctor's certificate is enclosed, which ensures the authenticity of the doctor's signature and in this way also the authenticity of the health data. This sounds simple; however, the complete procedure includes more aspects: the connector generates based on the health data a hash code. This hash code serves that while reading the data it can be determined that the data are complete and not changed by a third party. The connector sends the hash code to the HPC of the doctor. In the microprocessor of the HPC, the hash code is signed electronically and the certificate of the doctor is enclosed. As a result of this procedure, it can be ensured that the health data are authentic, i.e. the health data really belong to the specific patient and are generated and signed by the doctor.

❽ Further, all data are packed in a digital folder and prepared for the transmission.

As figure 15 shows, the encryption of health data includes several steps and all are necessary to ensure data protection, data security and privacy. In following figure 16 the reverse way is shown, namely how health data are decrypted. Again, it is assumed that the patient is at the doctor's office. However, in this example the doctor wants to look at the health data of the patient.
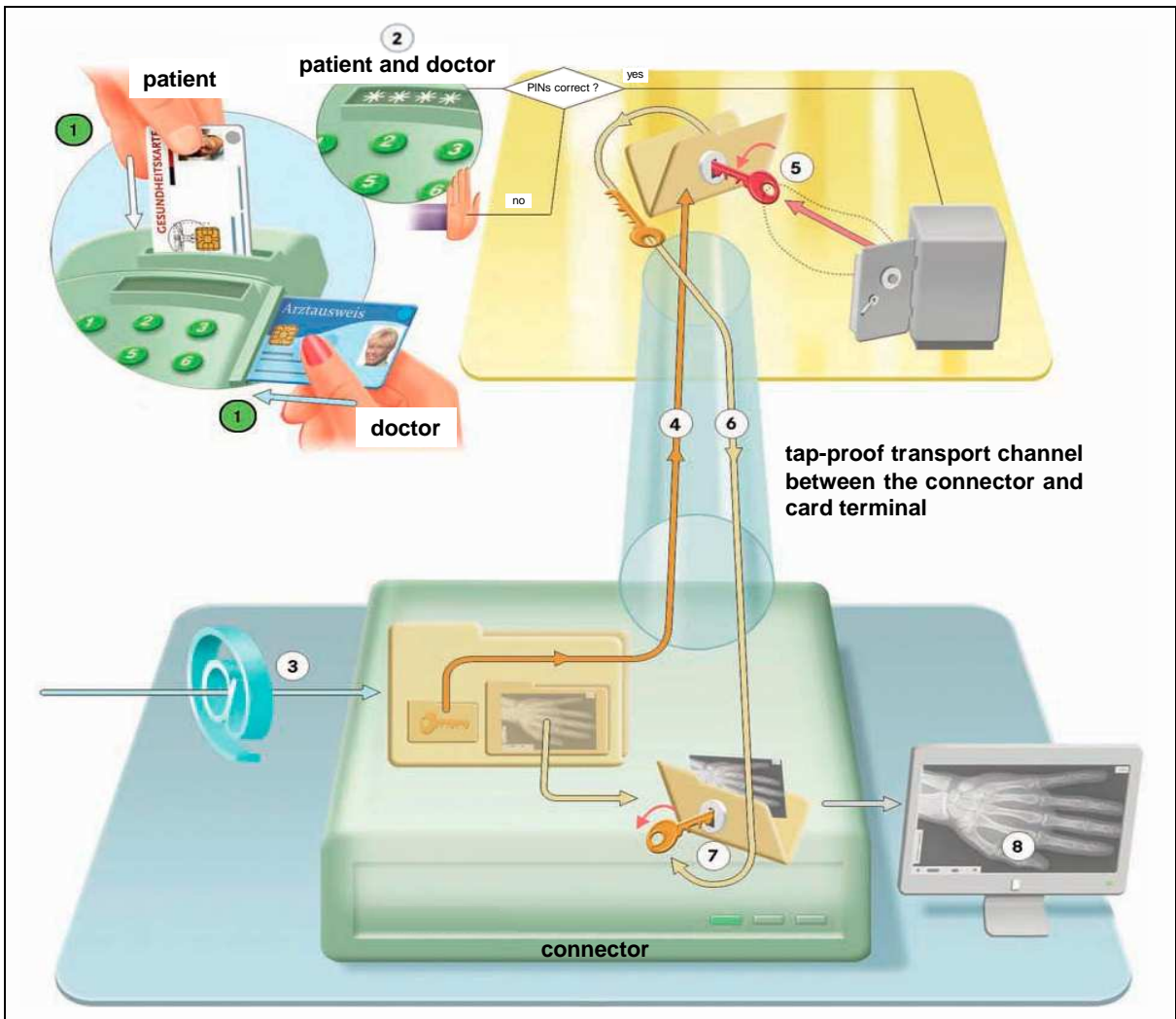
Figure 16: Health data decryption (adapted from gematik 2008a)

Figure 16 illustrates following steps (gematik 2008a):

❶,❷ The first two steps of the decryption of health data are the same as for the encryption procedure. Firstly, the patient has to insert his/her eHC and the doctor has to insert his/her HPC into the card terminal. Secondly, each actor has to enter the correct PIN. Only when both steps are processed correctly, the following steps can be conducted.

❸ The connector retrieves the requested digital folder from the telematics infrastructure.

❹ The encrypted secret key (symmetric key) is extracted from the digital folder and is sent through the tap-proof transport channel to the microprocessor of the eHC.

❺ In this eHC microprocessor, the decryption of the secret key (symmetric key) takes place. Thereby, the decryption is done by using the private key (asymmetric key) of the eHC holder.

It should be noted that the private key (asymmetric key) of the eHC holder never leaves the chip of the eHC.

❻ The decrypted secret key (symmetric key) is sent through the tap-proof transport channel to the connector.

❼ The connector decrypts the encrypted health data with the secret key (symmetric key).

❽ Finally, the decrypted health data are sent to the computer system of the doctor and can be represented on the computer screen.

Based on the presented facts, it is important to note that the telematics infrastructure requests continuous changes and improvements (gematik 2008a). The reason is that while technologies like encryption change rapidly, data protection, data security and privacy still have to be guaranteed (gematik 2008a). Therefore, the Federal Office for Information Security and the gematik have to work closely together (gematik 2008a).

In summary, it can be seen that the telematics infrastructure is the essential backbone of the eHC. Several components are presented, which are required, before health data can be transmitted via the telematics infrastructure. Examples are the eHC, HPC and connector. Further, it is shown that hybrid encryption is applied in order to make the data secure. In addition, an example for encryption and decryption of health data is given.

E-kiosks

As mentioned in section 2.2.4.4 and also shown on the basis of the telematics infrastructure, the patient has the control over his/her health data in Germany. This due can be ensured, while the patient is in a healthcare facility. Though, outside of such facilities, this right can only be guaranteed appropriately, if e-kiosks are implemented nationwide by statutory health insurance companies and connected with the telematics infrastructure (Zwicker et al. 2012b; Zwicker et al. 2012c; gematik 2013). The reason is that e-kiosks provide the necessary environment for enrollees/patients to exercise their rights (gematik 2013). In this way, it is conceivable that patients control their data by e.g. hiding their e-prescriptions – assumed they come at some stage in the future (gematik 2013).

However, even if such e-kiosks are implemented nationwide, there is still the barrier for the seriously disabled people to use these terminals (Zwicker et al. 2012b; Zwicker et al. 2012c). On the last day of 2009, Germany counted 7.1 million seriously disabled people or in other

words, 8.7 % of the population were seriously disabled (Statistisches Bundesamt Deutschland 2012). And these numbers include just the officially registered ones with a valid identification (Statistisches Bundesamt Deutschland 2012). Seriously disabled is defined as someone, who has an officially approved disability of 50 % and more (Statistisches Bundesamt Deutschland 2012).

Based on the data gained from the Statistisches Bundesamt Deutschland, in English Federal Statistical Office of Germany, the following figure 17 is created. This figure splits the seriously disabled people in accordance with their type of disability. As this figure shows, most of the disabilities belong to physical disabilities (Statistisches Bundesamt Deutschland 2012). Further, most of the seriously disabled people are confronted with a functional restriction of their viscera (Statistisches Bundesamt Deutschland 2012).
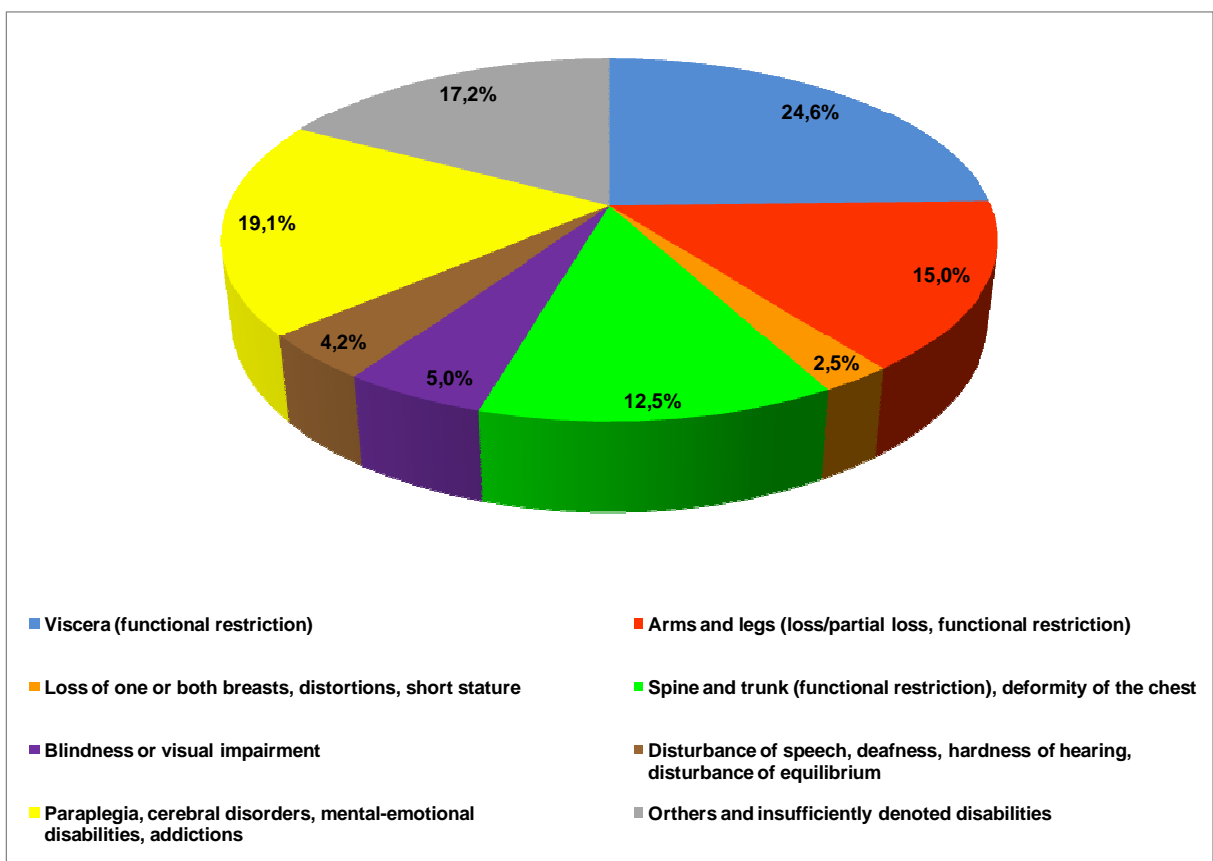
Figure 17: Split of the seriously disabled people in accordance with their type of disability (adapted from Statistisches Bundesamt Deutschland 2012)

The German law BGG (Equality Law for Disabled Persons) focuses on the equality of disabled people in Germany. In the context of e-kiosks, especially Section 4 BGG (Equality Law for Disabled Persons) needs to be mentioned, because in this Section the term "barrier-free" is defined. According to this Section, barrier-free is ensured, if disabled people are able

to access and use e.g. the facilities, systems and technical items in a commonly used way, without specific difficulty and without help. Based on these facts, it is essential to develop barrier-free e-kiosk systems (Zwicker et al. 2012b; Zwicker et al. 2012c).

Zwicker et al. have considered the barrier-free issue and have developed recommendations, how e-kiosk systems can be adapted to the specific needs of the seriously disabled people (Zwicker et al. 2012b; Zwicker et al. 2012c). The recommendations for each group of the seriously disabled people are presented in the following.

For the seriously disabled people, who have a functional restriction because of their arms and legs, Zwicker et al. advise the functionality of electronic height adjustments (Zwicker et al. 2012b; Zwicker et al. 2012c). These movements should be done by an easily accessible switch, which is also reachable for people in a wheelchair (Zwicker et al. 2012b; Zwicker et al. 2012c). People, who have lost or partial lost their arms and legs, are paraplegic or have a short stature are not explicitly mentioned by Zwicker et al., but these people benefit also from these suggestions (Zwicker et al. 2012b; Zwicker et al. 2012c). The reason is that their circumstances are comparable.

Further, for the seriously disabled people, who have a functional restriction due to their spine and trunk, it is as well advisable to have electronic height adjustments (Zwicker et al. 2012b; Zwicker et al. 2012c). In addition, a luggage rack for bags or other baggage is recommended for them, so that they can stand upright without having heavy luggage in their hands (Zwicker et al. 2012b; Zwicker et al. 2012c).

Most adaptations are necessary for the people, who are affected by blindness or visual impairment (Zwicker et al. 2012b; Zwicker et al. 2012c). Zwicker et al. suggest a telephone receiver through which the people can listen to a computer voice, which read the data out (Zwicker et al. 2012b; Zwicker et al. 2012c). Further, audible alarms and the usage of a Braille keyboard in combination with the appropriate Braille computer software are suggested (Zwicker et al. 2012b; Zwicker et al. 2012c). Moreover, specifically for people with visual impairment, it is recommended to allow changes in the front size of the text (Zwicker et al. 2012b; Zwicker et al. 2012c). However, such adaptations bring along the demand for isolated locations, because all these measures are potential risks for data protection, data security and privacy (Zwicker et al. 2012b; Zwicker et al. 2012c). One aspect, which is mentioned by Zwicker et al. in another context, but which can also help here, is the application of speech recognition software (Zwicker et al. 2012b; Zwicker et al. 2012c). This aid, however, is also a

potential risk for data protection, data security and privacy, because third people can listen what the seriously disabled people say.

According to Zwicker et al., the seriously disabled people with following disabilities do normally not request e-kiosk adaptations: viscera (functional restriction), disturbance of speech, hardness of hearing, disturbance of equilibrium, cerebral disorders and mental-emotional disabilities (Zwicker et al. 2012b; Zwicker et al. 2012c). People affected by the loss of one or both breasts, distortions, deformity of the chest, deafness and addictions are not considered by Zwicker et al. so far, but they also do not request specific adaptations (Zwicker et al. 2012b; Zwicker et al. 2012c). The reason is that all these seriously disabled people are able to operate the e-kiosks and to read the information mentioned on the display.

Beside the seriously disabled people, Zwicker et al. mention the illiterates, who need as well e-kiosk adaptations (Zwicker et al. 2012b; Zwicker et al. 2012c). A study published in 2011 shows that around 7.5 million people of the German population are functionally illiterate (Grotlüschen and Riekmann 2011). These people can write and read words and individual sentences, but not small texts and certainly not complete texts (Grotlüschen and Riekmann 2011). Zwicker et al. suggest that e-kiosk should be equipped with a telephone receiver and speech recognition software in order to satisfy these people's needs (Zwicker et al. 2012b; Zwicker et al. 2012c). While the people can listen through the telephone receiver to a computer voice, which reproduce the information, the speech recognition software is able to add the spoken text of these people to the system (Zwicker et al. 2012b; Zwicker et al. 2012c). However, this measure demands also isolated locations.

Overall, this section has shown that in order to ensure the patient's control over his/her health data appropriately, e-kiosks must be established nationwide. Because a lot of people are seriously disabled or functionally illiterate, these e-kiosks must be adapted to the specific needs. Several recommendations for the different group requirements have been presented.

2.2.5 Compare/Contrast between the Australian and German E-Health Solutions

This section conducts a comparison/contrast between the Australian e-health solution (see section 2.2.3) and the German e-health solution (see section 2.2.4). It should be noted that already presented facts are not cited again and that few translations are needed in this section.

The Australian e-health solution is based on an optional PCEHR, which is a summary of key medical information of a patient. The users of the Australian healthcare system can register

for their own PCEHR. The PCEHR system has several core services and draws on several foundation services. In addition, several e-communications are applied in Australia, which are essential, because the resulted health data can be shared with the PCEHR system. The German e-health solution is built on an eHC, which allows the application of several e-health functions. While the usage of the eHC and its administrative functions is compulsory for all enrollees with statutory health insurance, the medical functions are optional for them to use. Therefore, it can be seen, that both countries have chosen a different approach for providing a national e-health solution, but in both countries the medical functions are optional for the individuals to use.

The own development means for both countries a high investment. The Australian government had allocated around AU$ 467 million over a two year period (Department of Health and Ageing Australia 2011a; NEHTA 2013c). In Germany, based on study results, the gematik estimates the investment costs between € 14 billion and € 1.6 billion (gematik 2010o). However, it is important to note that the presented numbers of both countries do not clearly demonstrate which amount of these costs are pure development costs and which amount of these costs assign to pure implementation costs. The reason is that a detailed itemization and further descriptions to these numbers are currently not mentioned. Another aspect to be pointed out is that the own development is a time consuming endeavor for each country. While Australia was able to open the PCEHR registration on time, Germany started with a delay of almost five years and a revised implementation plan to rollout the eHC. However, even for Australia the own development took years.

Further, the functionality of each national e-health solution is limited so far. Even if the Australian PCEHR is open for registration, it should be noted that the system still needs further work and also patient's health data need to be incorporated into the system. In Germany, the eHC has currently no medical functions available. However, in both countries the medical functions need to be available and working in order to vindicate the costs and the effort.

Another aspect is that both countries see it as a strict necessity to ensure data protection, data security and privacy. Therefore, both countries have developed several measures to ensure these issues. Furthermore, Australia focuses on an underlying telematics infrastructure for its PCEHR system, as well as Germany for its eHC.

Before a further comparison/contrast between both national e-health solutions can be proceed appropriately, especially when looking on the "e's" in e-health and on a SWOT analysis, it is

important from now on to assume that both solutions are available and working in their full amount. This means for Australia a ready PCEHR system including health data summaries of patients. For Germany this means an eHC, which offers several medical functions including an EHR. The reason for this assumption is simply that the functionality in both countries is limited so far. The reason to assume the EHR in Germany is that this e-health function is the most comprehensive e-health function, even if the further proceeding of the EHR is unclear at the moment. However, the current implementation plan includes the electronic case file, which is a lower version of the EHR. Therefore and because the EHR was part of the initial implementation plan and is still mentioned in Section 291a SGB V (Code of Social Law, Volume Five), it is not unreasonable that Germany will have an EHR in the future.

Looking in the future, Australia has the possibility of using a PCEHR. In Germany, the eHC brings e-health functions like an EHR along. Based on these facts, it is important to have a closer look at the difference between the Australian PCEHR and the German EHR. In this way, the following figure 18 shows the health record continuum. While a personal health record is controlled by an individual himself/herself, an electronic health record is controlled by healthcare providers (Muhammad et al. 2012). In the middle of these two extremes, a PCEHR is located (Muhammad et al. 2012). It can be seen, that the control is here the underlying factor.
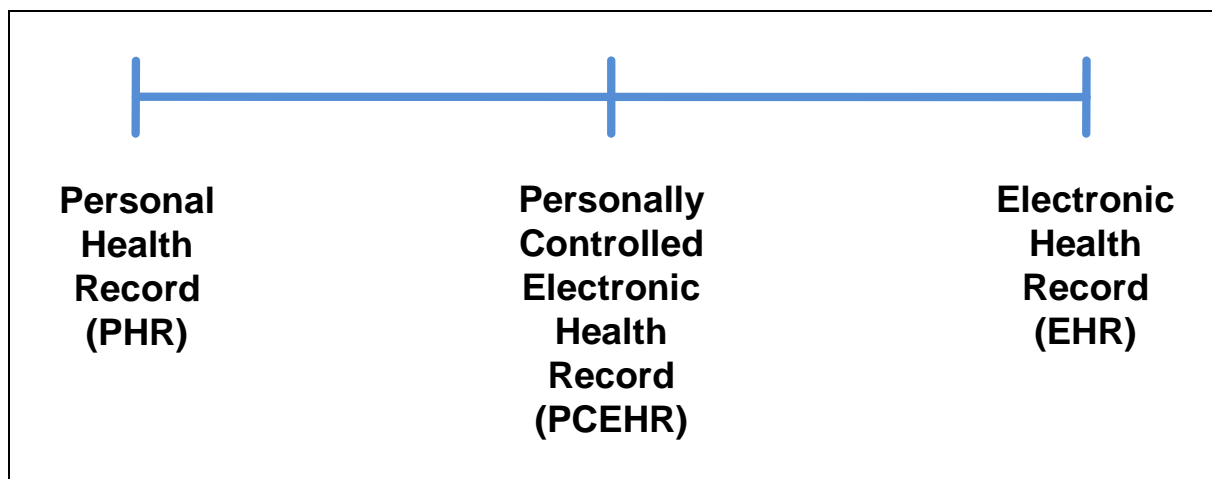
Figure 18: The health record continuum (adapted from Muhammad et al. 2012)

In Australia, the registration for an own PCEHR is voluntary. Further, the patient as well as the healthcare providers can add health data to the PCEHR and can have a look at the PCEHR. Though, it must be noted that the healthcare providers need the necessary consent of the patient. Overall, this means that the patient and the healthcare providers share the access and responsibility, whereas the patient controls the whole issue (Muhammad et al. 2012).

In Germany, assumed the EHR is implemented, the healthcare providers can read the stored patient's health data or they can add health data to the specific EHR. However, the medical functions are optional in Germany, which means that only the patient decides which medical functions are applied for him/her. In addition, healthcare providers need the patient's consent, before they can view/store the health data of a patient in the EHR. Specifically, they need the patient's eHC in combination with his/her PIN. On the other hand, the patient is not able to view his/her EHR outside of healthcare facilities so far, because this issue requires the necessary equipment including a HPC and also an access to the telematics infrastructure. However, e-kiosks can change this situation, because depending on the available e-kiosk functions in the future, it is conceivable that patients can use them to read their stored health data. Though, as Section 291a SGB V (Code of Social Law, Volume Five) currently requires an HPC, before health data can be accessed, appropriate changes in the law are needed first. Based on these facts, it can be concluded that the German EHR is not a classical healthcare provider-controlled EHR, because it is more located between the classical healthcare provider-controlled EHR and the Australian PCEHR. At the end, it should be noted that this conclusion assumes that patients are not able to add own information to the EHR, because otherwise the German EHR moves even more in the direction of the Australian PCEHR. Though, such functionality needs to be implemented at some stage, as it is requested by Section 291a SGB V (Code of Social Law, Volume Five). The gematik lists this functionality very sparely and as a separate e-health function (gematik 2010j). In addition, the two implementation plans have not considered this functionality so far. Consequently, this thesis also omits this e-health function, because the necessary base and details are not given.

At this stage of the comparison/contrast between the Australian PCEHR and the German EHR, one major difference between both alternatives needs to be pointed out. The Australian PCEHR represents a summary of health data, while the German EHR can include the complete medical history of a patient. However, this fact does not depend on the control rather than on the respective specification.

Other aspects to incorporate into this comparison/contrast between the Australian and German national e-health solutions are the "e's" in e-health. Section 2.2.2 has mentioned that countries have to incorporate the "e's" in e-health, while they work on their national e-health solutions. Zwicker et al. have already evaluated the German national e-health solution for its consideration of eight of the overall ten "e's" in e-health and have presented their findings in the form of a table (Zwicker et al. 2012b). In the following, the table from Zwicker et al. is revisited and extended with the evaluation of the Australian national e-health solution for its

consideration of the ten "e's" in e-health (Zwicker et al. 2012b). Further, the German part is extended with the two omitted "e's", i.e. "encouragement" and "enabling" (Zwicker et al. 2012b). The results for both national e-health solutions are presented in the following table 4.

The e's in e-health	Australian e-health solution	German e-health solution
Efficiency	The PCEHR and the e-communications help to decrease costs, because e.g. they allow to avoid needless or duplicative treatments and to improve the communication among healthcare actors.	The eHC and its e-health functions help to decrease costs, e.g. needless or duplicative treatments can be avoided and the communication among healthcare actors can be improved.
Enhancing quality of care	The PCEHR allows different healthcare actors to have a look at the health data summary of a patient. This supports healthcare actors, because they can use these health data to reduce incorrect treatments, which result in turn in a higher quality of care.	Especially the EHR improves the communication and information exchange among the healthcare actors, which can reduce incorrect treatments and thus result in a higher quality of care.
Evidence based	The PCEHR supports evidence based medicine. With the access to a PCEHR, it is possible for the doctor to see the health data summary of a patient, which he/she can use for his/her diagnosis/treatment. Further, the doctor is able to include health data, which are provided by the patient.	The eHC supports evidence based medicine. With the access to e.g. an EHR, it is possible for the doctor to incorporate former diagnoses and treatments from other doctors in his/her diagnosis/treatment.
Empowerment of consumers and patients	The PCEHR gives the patient the possibility to view the summary of his/her health data. In addition, the PCEHR allows patients to add own data.	The eHC gives the patient the possibility to view his/her health data. However, among others, access to the telematics infrastructure is required. So far, also a HPC is needed.
Encouragement	The PCEHR allows joint decisions, because both patients and healthcare providers need each other. For example, patients have to give their consent, before healthcare providers can access the health data summary.	The eHC allows joint decisions, because both patients and healthcare providers need each other. For example, patients have to give their consent, before healthcare providers are able to access the health data.
Education	The PCEHR does not include this issue.	The eHC does not include this issue.
Enabling	The PCEHR and the e-communications enable a standardized communication and information exchange among the healthcare actors.	The eHC and its e-health functions enable a standardized communication and information exchange among the healthcare actors.
Extending the scope of healthcare	The conceptual scope of healthcare can be favorable affected through the PCEHR, as new possibilities/processes are available. The geographical scope is normally the same, because healthcare should be accessible throughout Australia.	The conceptual scope of healthcare can be favorable affected through the eHC, as new possibilities/processes are available. However the geographical scope is the same, because healthcare is already accessible throughout Germany.
Ethics	In Australia exist strict laws, ethical and professional codes and techniques, which ensure the correct dealing with people and in addition the privacy of the patients.	In Germany exist strict laws and techniques, which guarantee the correct dealing with people and also the privacy of the patients.
Equity	Equity is a problem in Australia, because so far there is no solution for the seriously disabled people, the illiterates as well as the elderly.	For ensuring equity, it is, among others, necessary to implement barrier-free e-kiosks. However, the elderly still have a barrier to overcome.

Table 4: Evaluation of the Australian and German national e-health solutions in terms of the "e's" in e-health (adapted from Zwicker et al. 2012b)

Based on table 4, it can be seen that the Australian national e-health solution and German national e-health solution consider except "education" all the other "e's" in e-health. If both national e-health solutions are compared/contrasted based on the table results, three major differences can be identified. Firstly, in Australia the equity issue is a high risk, because it is quite unclear so far, how e.g. seriously disabled people should be able to use the PCEHR system. For Germany exist at least recommendations for developing barrier-free e-kiosks for seriously disabled people and further the e-kiosks are in the responsibility of statutory health insurance companies. Secondly, because the PCEHR represents only a summary of health data, the benefits can be smaller compared to an EHR, where the patient can agree to a full upload of his/her health data. Thirdly, the PCEHR allows consumers/patients to add own data, which leads in this way especially to a higher empowerment of consumers/patients.

At the end of the comparison/contrast between the Australian and German national e-health solutions, the major strengths, weaknesses, opportunities and threats (SWOT) of each national e-health solution are presented. The data originate primarily from Zwicker et al., who have already compiled these facts (Zwicker et al. 2012a; Zwicker et al. 2014). However, it should be noted that the facts from Zwicker et al. (2012a; 2014) are updated and extended based on the information presented about the Australian national e-health solution (see section 2.2.3), the German national e-health solution (see section 2.2.4) and their comparison/contrast in this section. The results are presented in table 5. As each country implements its own e-health solution, it is not surprising that among both national e-health solutions deviations exist.

Table 5 illustrates similar results as already identified earlier in this section. The Australian solution represents only a summary of health data, while the German solution and especially the EHR can include the complete medical history of a patient. The summary can be a problem, because essential details can be missed, while the complete overview can lead to an information overload. In addition, while patients using a PCEHR can view their health data, patients having an eHC can only view their health data in healthcare facilities so far. Further, the PCEHR allows patients to add own data, while in Germany no concrete plan for such functionality exists so far. However, what really needs to be pointed out clearly is the fact that in Australia still a network of fragmented systems exits (NEHTA 2013d). Examples to be mentioned here are the e-communications. These e-communications of course allow the sharing of health data with the PCEHR system; however, they use different infrastructures than the PCEHR system infrastructure (NEHTA 2011b). In Germany, the e-health functions like emergency data record, documentation of medicine and EHR are all related to the eHC and they are processed via the single telematics infrastructure.

	Australian e-health solution	German e-health solution
Strengths	- Better information exchange - Time savings - Cost savings - Higher quality of care - Patients can view the health data - Patients are able to add own data	- Better information exchange - Time savings - Cost savings - Higher quality of care - EHR can allow a full overview of the patient's medical history - A single telematics infrastructure - Smart card (eHC): consumers have something in their hands
Weaknesses	- High investment costs - Time for the own development and implementation of the PCEHR system and the e-communications - Several decision makers - The PCEHR is just a summary of health data - Different underlying systems with separate infrastructures	- High investment costs - Time for the own development and implementation of the eHC including all e-health functions - Several decision makers - Patients can only view the health data in healthcare facilities so far - Patients are not able to add own data so far
Opportunities	- Contribution to life savings - Potential to reduce health expenditure - Extending the scope of healthcare delivery - Possibility for health information exchange with other countries - First step for a health information exchange between different stakeholders worldwide (NCHO)	- Contribution to life savings - Potential to reduce health expenditure - Extending the scope of healthcare delivery - Possibility for health information exchange with other countries - First step for a health information exchange between different stakeholders worldwide (NCHO)
Threats	- Data protection, data security and privacy - Acceptance - New laws - Several decision makers - Doctors may need overall more time - Summary of health data (PCEHR): essential information can be missed for the doctors - Different underlying systems with separate infrastructures: high risk for superior healthcare delivery	- Data protection, data security and privacy - Acceptance - New laws - Several decision makers - Doctors may need overall more time - Information overload: doctors can lose overview

Table 5: SWOT of the Australian and German national e-health solutions (adapted from Zwicker et al. 2012a; Zwicker et al. 2014)

Table 5 also shows that both countries are looking at a national e-health solution, which is a first step for a health information exchange between different healthcare players worldwide. In this way, it can allow network centric healthcare operations (NCHO) in the future, which is explained further in section 2.3. However, while Germany has already a single telematics infrastructure to connect the different healthcare players, Australia is struggling on this issue, as they use different infrastructures for the different systems and consequently a seamless health information exchange among the different Australian healthcare players cannot be ensured (Zwicker et al. 2012a; Zwicker et al. 2014).

In summary, this section has presented a comparison/contrast between the Australian and the German national e-health solutions. As shown, both countries use a different approach, but the medical functions are optional for the consumers. As also mentioned, for both countries the own development results in high investment costs and a time consuming endeavor. Further, while the Australian PCEHR represents only a summary of health data, the German EHR can include the complete medical history of a patient. In addition, while patients using a PCEHR can look at the health data and are able to add own data, patients having an eHC can only view the health data in healthcare facilities and are not able to add own data so far. Moreover, an essential finding is that Australia is still confronted with the problem of different systems, which are based on different infrastructures. Therefore, Australia has further work to do in order to connect the healthcare system and its healthcare players closer, before they can concentrate on NCHO with other countries. Finally, it should be noted that both national e-health solutions cannot prevent the situation that in both countries, different healthcare players like hospitals as well develop and implement own e-health services/functions or even a complete hospital e-health solution, which they use parallel.

2.3 Network Centric Healthcare

This section presents details about network centric healthcare, which is the underlying theory of this study. The doctrine of network centric healthcare operations (NCHO) is defined as "unhindered networking operations within and among the physical, information, and cognitive domains that govern all activities conducted in healthcare space based on free, multidirectional flow and exchange of information without regard to the involved platforms or platform-systems, and utilising all available means of ICCTs to facilitate such operations" (von Lubitz and Patricelli 2007, p. 103; von Lubitz and Wickramasinghe 2006; Wickramasinghe and Schaffer 2010). The term ICCT means information, computer and communication technologies.

Related to this definition, the idea of NCHO is to facilitate networking operations without hindrance, which in turn allow an unrestricted, multidirectional flow as well as exchange of health information (von Lubitz and Patricelli 2007; von Lubitz and Wickramasinghe 2006; Wickramasinghe and Schaffer 2010). However, as this definition also highlights, there exist three domains, which have to interact and overlap in order to facilitate NCHO (von Lubitz and Wickramasinghe 2006; Wickramasinghe et al. 2007; Wickramasinghe and Schaffer 2010):

1. **Physical domain (process):** the focus of this domain lies on the process issue. This means that the physical domain comprises the structure of the complete environment, which healthcare operations aim to influence in a direct or in an indirect way. Examples are the education of patients or employees, the political setting or the financial operations.

2. **Information domain (technology):** the focus of this domain is on the technology. That implies that the information domain includes all the necessary components, which are requisite in order to deal with information (i.e. creation, storage, sharing and manipulation), but also for the information transformation and sharing as knowledge.

3. **Cognitive domain (people):** the focus of this domain refers to the people. This means that the cognitive domain encompasses the human factors, which influence such operations. Examples are the training, education, knowledge or incentive of the people, who are involved in the germane actions.

Based on the given definition of NCHO and the explanation of the three domains, it can be seen that the realization of NCHO is a challenging endeavor. All three domains, i.e. process, technology, and people, must interact and overlap, because otherwise NCHO cannot happen (von Lubitz and Wickramasinghe 2006; Wickramasinghe et al. 2007; Wickramasinghe and Schaffer 2010). Further, in order to facilitate such operations on a global scale, it is necessary to realize a global telematics infrastructure. This global telematics infrastructure is called in the literature the worldwide healthcare information grid (WHIG) (von Lubitz and Wickramasinghe 2006; von Lubitz and Patricelli 2007; Wickramasinghe et al. 2007).

This WHIG requires an interconnected matrix of multiple ICCT systems and the inclusion of the necessary processes, technologies and people on a local, national, international and global scale (von Lubitz and Wickramasinghe 2006; von Lubitz and Patricelli 2007; Wickramasinghe et al. 2007). With the application of a WHIG, it is possible to facilitate a

complete and unhindered sharing of a multiplicity of information between the various domains, the domain's elements, but also between the elements across the various domains (von Lubitz and Wickramasinghe 2006; von Lubitz and Patricelli 2007; Wickramasinghe et al. 2007; Wickramasinghe and Schaffer 2010). This means that through NCHO, it is possible to achieve an unrestricted, multidirectional flow as well as exchange of health information among different countries and different healthcare players globally. The following figure 19 illustrates the WHIG.
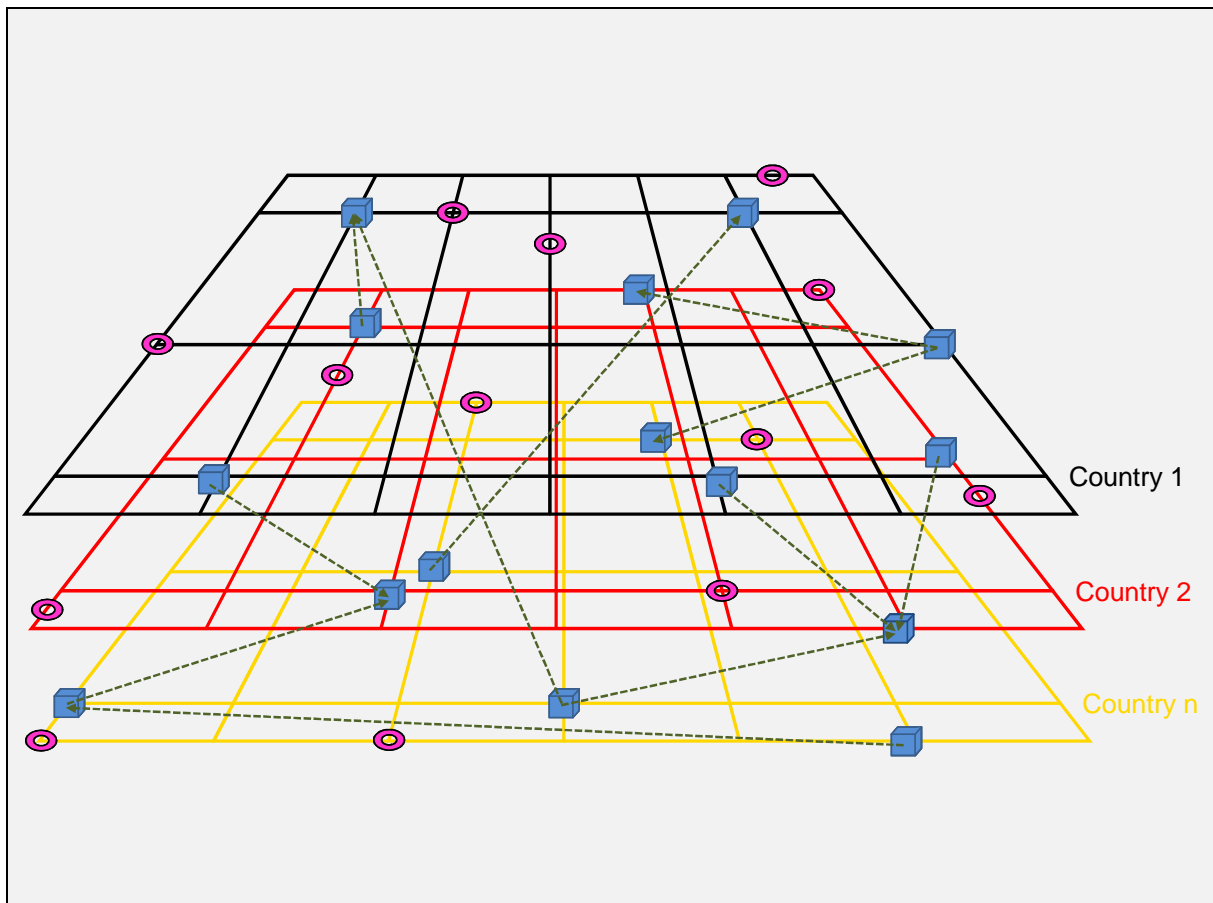
Figure 19: Schematic of the WHIG (adapted from von Lubitz and Wickramasinghe 2006; von Lubitz and Patricelli 2007; Wickramasinghe et al. 2007; Zwicker et al. 2012a)
[Because countries and their healthcare systems are different, the different layers have a different color. The pink ellipses symbolize entry points and the blue cubes symbolize nodes. In these nodes, the information/data in the network is/are further refined as well as processed by intelligence capabilities.]

As a consequence of the presented facts, the actual challenges and the external pressures, it is important for countries including healthcare organization to design e-health solutions, which have a global/network centric perspective and support in this way NCHO (Wickramasinghe et al. 2007; Wickramasinghe and Schaffer 2010). In other words, it is essential that there exists a macro understanding of the necessity of an appropriate e-health design (Wickramasinghe et al. 2007; Wickramasinghe and Schaffer 2010). According to this, it is essential to investigate

how to realize an appropriate e-health design. In order to do this, it is important to understand how to transfer different national e-health solutions to other countries and thereby to develop a global e-health solution. Further, the transfer of one suitable national e-health solution to other countries is one way, how countries can implement a national e-health solution with a global/network centric perspective and to avoid the risks of an own development. This is exactly what the research question of this study investigates.

At the end, it should be noticed that most of the facts presented in this section are already published by the researcher (see Zwicker et al. 2012a; Zwicker et al. 2014).

2.4 Culture

This section discusses the culture issue. The reason is that cultural differences might have an impact on the outcome of the study in two ways. Firstly, data collection is conducted in two different countries, namely Australia and Germany. Secondly, because this study examines the transferability of e-health solutions to other countries, it is not unreasonable that culture could be one of the barriers or findings for a successful transfer.

It is important that the culture is seen separately from the human nature and the personality of each person (Hofstede 2001; Hofstede et al. 2010). This context can be illustrated by using a pyramid (Hofstede 2001; Hofstede et al. 2010). While the human nature is located at the bottom of the pyramid and the personality at the top of the pyramid, the culture is located in the middle (Hofstede 2001; Hofstede et al. 2010). The borders between culture and the other two neighboring issues cannot be exactly stated (Hofstede 2001; Hofstede et al. 2010). The human nature encompasses the inherited issues, which all or most people in the world have together (Hofstede 2001; Hofstede et al. 2010). On the other hand, the personality of each person is unique, which means that it just relates to the specific person (Hofstede 2001; Hofstede et al. 2010). Further, the personality combines partly inherited and partly learned issues (Hofstede 2001; Hofstede et al. 2010). The culture, however, is something, which is learned and which is derived from the social environment of an individual (Hofstede 2001; Hofstede et al. 2010). This means that culture refers to a particular category or else group of individuals (Hofstede 2001; Hofstede et al. 2010).

Culture is defined as "a system of shared beliefs, values, practices, perspectives, folk knowledge, language, norms, rituals, and material objects and artifacts that members of a group use in understanding their world and in relating to others" (Johnson and Christensen

2008, p. 400). Based on all these cultural issues like shared beliefs, shared values and shared language, it is not unthinkable that among the different cultures various distinctions can exit.

The communication and collaboration across cultures can be a challenging effort. The language takes an essential role for dealings across cultures (Hofstede 2001; Hofstede et al. 2010). In addition, when people visit an unknown cultural environment, they live through four sequent periods of different feelings (Hofstede 2001; Hofstede et al. 2010). Zapf shows that the names of these different periods vary depending on the specific author(s) (Zapf 1991). Beside these examples, a further well known way of naming these periods is "euphoria", "culture shock", "acculturation" and "stable state" (Hofstede 2001; Hofstede et al. 2010). In the beginning, the euphoria leads to a positive feeling. However, when the people are confronted with the real life, the culture shock arises and brings a negative feeling along (Hofstede 2001; Hofstede et al. 2010). Because people are able to adapt themselves to new situations, they are also able to acculturate themselves to the new cultural environment (Hofstede 2001; Hofstede et al. 2010). In the last period, the situation stabilizes (Hofstede 2001; Hofstede et al. 2010). However, the question is how the feeling is, because it can be positive, negative or neutral (Hofstede 2001; Hofstede et al. 2010).

Another aspect to consider in this context is that fact that communication technologies cannot avoid that culture happens (Hofstede et al. 2010). The technology can be globalized and can help to exchange information around the globe; however, this does not mean that people absorb all the obtained information or that they amend their values (Hofstede et al. 2010). Such technologies strengthen our awareness in order to recognize distinctions within and among different countries (Hofstede et al. 2010).

These challenges mentioned for the communication and collaboration across cultures can be also relevant for the transfer of a national e-health solution from one country to other countries. The reason is that such a transfer does not just comprise the technology itself, rather the combination of processes, technologies and people. Especially the people have to speak to each other and have to collaborate across the involved countries, because otherwise a transfer cannot happen.

In addition, it must be pointed out that culture has also an effect on diverse local business procedures (Steers et al. 2010). Examples to be mentioned are finance, financial reporting or accounting procedures (Steers et al. 2010). However, given the context of the study, another important example to bring up is healthcare (Hofstede et al. 2010). In healthcare, there exist differences in medical treatments and procedures across countries (Hofstede et al. 2010). In

addition, it is evidenced that cultural traditions also have an impact on how people deal with medicine (Hofstede et al. 2010). Both aspects are very important to consider, because a transferred e-health solution need to fit to the processes and necessities of a country and its various people.

At the end, it is important to note that culture can happen on a macro and on a micro level, meaning that there is macro culture and micro culture (Johnson and Christensen 2008). While the macro culture can for example look at the country level, i.e. the Australian citizens, the micro culture can for example focus on just a specific group, i.e. the surgeons of a hospital (Johnson and Christensen 2008).

In summary, it is shown that culture needs always to be considered, especially when the study and the research question involve different countries and people. In addition, it is shown that culture is not just a question of e.g. different beliefs or values, as it is a combination of several aspects.

2.5 Summary

The literature review has given several important details. Firstly, different healthcare systems were presented. As an example for a mostly private healthcare system, the U.S. healthcare system was mentioned, while as an example for a mostly public healthcare system, the U.K. healthcare system was explained. Furthermore, the Australian and the German healthcare systems were demonstrated as examples for two-tier healthcare systems. As it was shown in the literature review, none of the healthcare systems equals exactly the other healthcare system.

Secondly, the literature review has presented details about e-health. In this way, necessary considerations and preparations for e-health were shown. Further, the ten "e's" in e-health were mentioned. In addition, the Australian and the German national e-health solutions were explained and as well compared/contrasted.

Thirdly, the doctrine of network centric healthcare was highlighted, which is the underlying theory of this study. In detail, it was also explained that in order to realize NCHO, it is important that the three domains, i.e. process, technology, and people, interact and overlap and also that a worldwide healthcare information grid is established. In addition, it was shown that there is a need to design e-health solutions, which have a global/network centric perspective. Based on this, the link to the research question was given.

Finally, details about the culture were presented. As shown, culture is a sensitive issue and need to be considered, especially because this study and the research question involve different countries and people and therefore cultural differences might have an impact on the outcome of the study.

CHAPTER 3

3. Methodology and Research Design

This chapter presents firstly the methodology and secondly the research design used in order to collect and analyze data and as a result to answer the research question "How can different e-health solutions be transferred to other countries?" and its necessary sub-questions.

Section 3.1 presents the methodology used. In this manner, qualitative research (subsection 3.1.1), quantitative research (subsection 3.1.2) and mixed research (subsection 3.1.3) are discussed. Section 3.2 explains the research design used. Thereby, subsection 3.2.1 gives details about the case study method itself and further about the case study in Australia and the case study in Germany including interviews (subsection 3.2.1.1) and a questionnaire (subsection 3.2.1.2). Subsection 3.2.2 explains the ethnographic study method and gives details about the ethnographic study in Australia and the ethnographic study in Germany. In addition, details about the ethics application and approval (subsection 3.2.3), the data analysis (subsection 3.2.4) as well as the validity of data (subsection 3.2.5) are presented. Finally, section 3.3 gives a summary of this chapter.

3.1 Methodology

There exist three key research approaches, qualitative research, quantitative research and mixed research (Creswell 2003; Johnson and Christensen 2008; Venkatesh et al. 2013). Johnson and Christensen see these three key research approaches as a research continuum, which is presented in figure 20 (Johnson and Christensen 2008). Others suggest that a mixed research enables the integration of qualitative and quantitative approaches in a fashion that can yield insights beyond that of either approach used independently (Venkatesh et al. 2013).
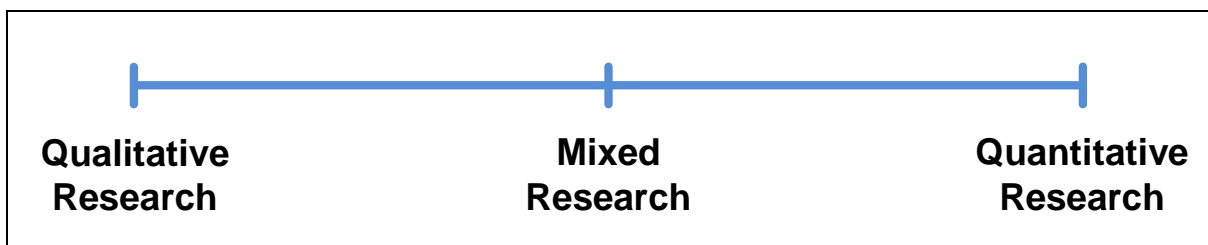

Figure 20: The research continuum (adapted from Johnson and Christensen 2008)

3.1.1 Qualitative Research

Qualitative research focuses on nonnumerical data like words, suggestions and ideas instead of numerical data (Johnson and Christensen 2008). In comparison to quantitative research,

this approach is used to illustrate what is seen and to create new hypotheses or theories (Johnson and Christensen 2008). It is appropriate to use qualitative research when a phenomenon or topic is mainly unknown (Johnson and Christensen 2008). Through applying the qualitative research the researcher can investigate the phenomenon or topic in order to create new knowledge (Johnson and Christensen 2008). People's behavior is expected to be dynamic, situational, personal, social, etc., and their perception of the world can be different (Johnson and Christensen 2008). Therefore, this approach focuses on a "wide- and deep-angle lens", in which phenomena or topics will be studied in broadness and deepness, without interfering with the natural behavior (Johnson and Christensen 2008). The qualitative researcher is an important part of this approach, because he/she serves as a data collection instrument (Johnson and Christensen 2008). This means that the researcher asks questions, collects information, interprets them, etc. (Johnson and Christensen 2008). For the qualitative researcher it is essential to get familiar with the insiders' viewpoints and their cultures by getting close to their study objects (Johnson and Christensen 2008). In the end, the researcher wants to identify categories and general themes based on data, which are typically collected by detailed interviews and/or observations (Johnson and Christensen 2008).

3.1.2 Quantitative Research

Quantitative research focuses on collecting measurable, numerical data and hypotheses or theories are tested (Johnson and Christensen 2008). In quantitative research, it is assumed that the behavior of the people is regular and can be foreseen (Johnson and Christensen 2008). Often this kind of research focuses on a "narrow-angle lens", because merely one or a few factors are focused concurrently (Johnson and Christensen 2008). The researcher tries to be neutral and keep away from human bias by keeping a distance (Johnson and Christensen 2008). For the quantitative research standardized questionnaires can be used as a tool and it is possible e.g. to use a scoring scale e.g. between one and five, where one stands for "strongly disagree" and five means "strongly agree" (Johnson and Christensen 2008). Based on these answers, the researcher can calculate for example an average or frequency for each group (Johnson and Christensen 2008).

3.1.3 Mixed Research

Mixed research uses both qualitative and quantitative methods as a mix to investigate the world in a more detailed manner (Johnson and Christensen 2008). The balance used between qualitative and quantitative research approaches and methods depends primarily on the

study's research question (Johnson and Christensen 2008). This mixed research collects qualitative as well as quantitative data and focuses on both the insider and outsider viewpoints (Johnson and Christensen 2008). Therefore, a researcher can use and balance between all three lenses, "wide-angle lens", "deep-angle lens" and "narrow-angle lens" (Johnson and Christensen 2008).

3.1.4 Selected Research Approach

This study adopts a mixed research approach, because qualitative as well as quantitative data are required to understand the study's context more detailed and to answer the research question.

Firstly, qualitative data will help to answer the research question directly, because these data can show how different e-health solutions can be transferred to other countries. Thereby, these data can also help to identify key factors or barriers that influence the transferability of e-health solutions. In addition, as this is a new evolving area, qualitative techniques will help to generate new hypotheses or theories. In order to realize this, interviews in Australia and interviews in Germany are conducted with important e-health stakeholders. Thereby, an interview protocol is used (see appendix 1). Additionally, an ethnographic study in Australia and an ethnographic study in Germany are executed.

Secondly, quantitative data will help to identify the general acceptance and opinion about the particular e-health solution in Australia and in Germany. It will also serve to analyze the transferability of e-health solutions to other countries. The quantitative data will help supportively to answer the research question. In this way, the researcher has developed a questionnaire (see appendix 2).

The case study in Australia and the case study in Germany incorporate qualitative and quantitative data. The case study in each country includes interviews (qualitative data) and a questionnaire (quantitative data). In addition, an ethnographic study (qualitative data) in Australia and an ethnographic study (qualitative data) in Germany are conducted. Further details and explanations of the case study method and the ethnographic study method are presented in the research design section (see section 3.2) and its subsections.

The following figure 21 illustrates the mixed methodology adopted for this study.
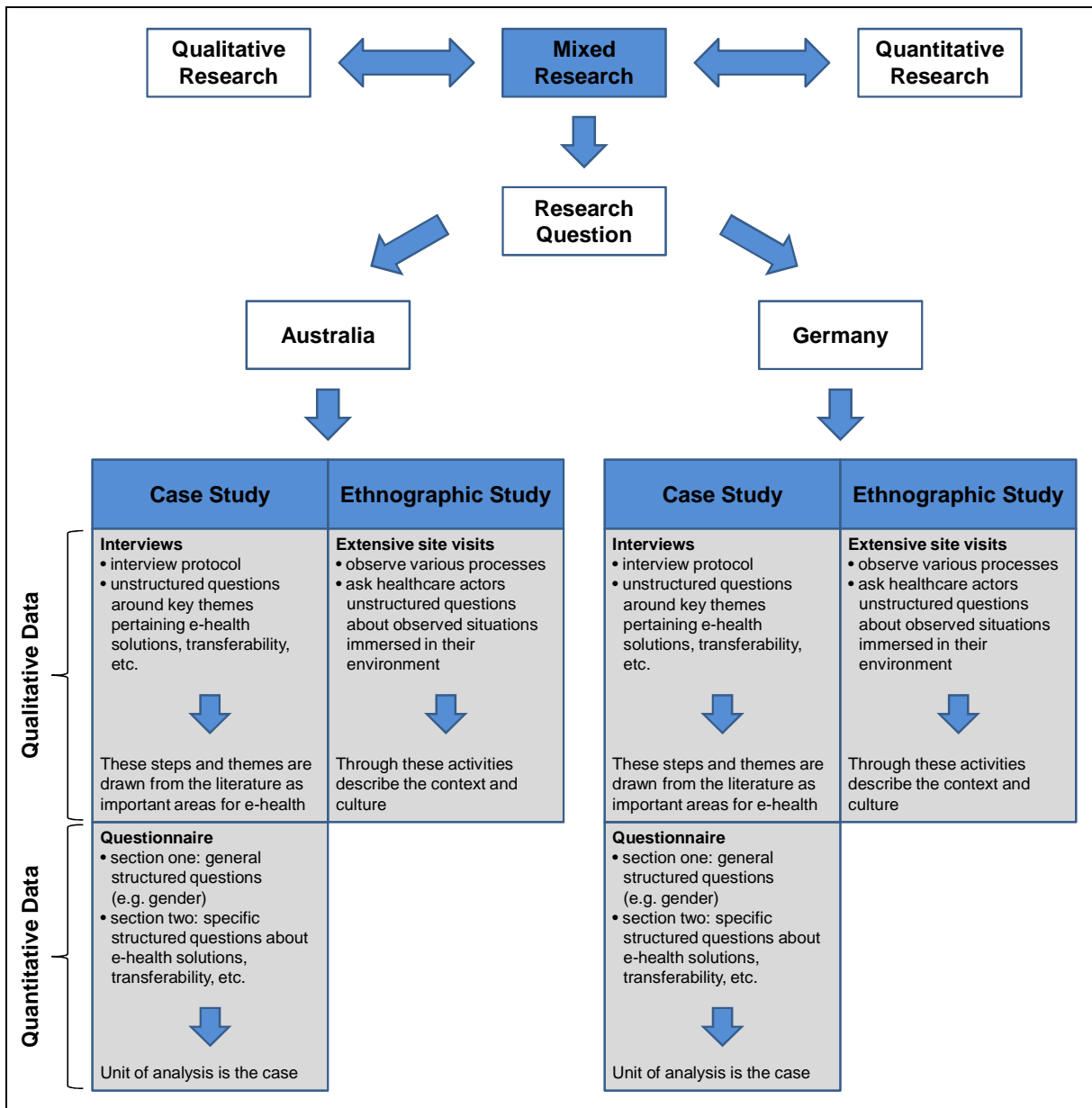
Figure 21: Mixed methodology adopted

3.2 Research Design

This section presents the research design of this study. In doing so, this section gives details about the different considered and conducted steps.

The following figure 22 shows the research flow diagram including the research design used for this study. The research design starts with the detection of the research problem and the research question and ends with the submission of the completed thesis.

This study is focused on Australia and Germany and in both countries data collection with the same data collection methods are conducted. Therefore, the steps mentioned in figure 22 are in general valid for both countries. However, it is important to note that some steps are

conducted for each country separately, which are bordered with a dashed red line in figure 22. It should be also considered that some steps need both a national and a cross-national consideration like the ethics approval and data analysis procedure.

Additionally, figure 22 highlights in blue the different data collection methods used in Australia as well as in Germany. It also shows where for each data collection method separate steps were necessary.

Taken together all the steps shown in the research design including the case study in Australia and the case study in Germany as well as the ethnographic study in both countries ensures that a systematic lens of analysis is used and the highest standards of rigor is adopted at all times. Overall, this should lead to significant results in the end.

Going one step further, figure 23 shows the conceptual framework including the micro, mezzo and macro view of this study. In addition, this graph assigns the different data collection methods used in Australia and Germany to the respective view.

The **micro** view is focused on the level of national e-health stakeholders like hospitals, pharmacies, etc. The ethnographic study in Australia and the ethnographic study in Germany give a detailed view about hospitals in each country. Furthermore, the micro view relies also on little information from the case study in Australia and the case study in Germany.

The **mezzo** view relies on the case study in Australia and the case study in Germany. The focus of the mezzo view is, among other things, on the respective federal government and the national e-health institutions/organizations. They have to coordinate the needs from the micro perspective with the needs from the macro perspective and discuss these issues against each other.

The **macro** view is also based on the case study in Australia and the case study in Germany. The focus of the macro view is for each country on the implementation of a national e-health solution. Thereby, the national e-health solution can be either an own development or a transferred national e-health solution from another country. How such a transfer can be realized is the focus of this study and its research question.

Taken together all three perspectives (micro, mezzo and macro) and trade those off against each other are an essential procedure in order to answer the research question and its sub-questions. In addition, it will also help to identify viewpoints, needs, etc., from the different e-health stakeholders.
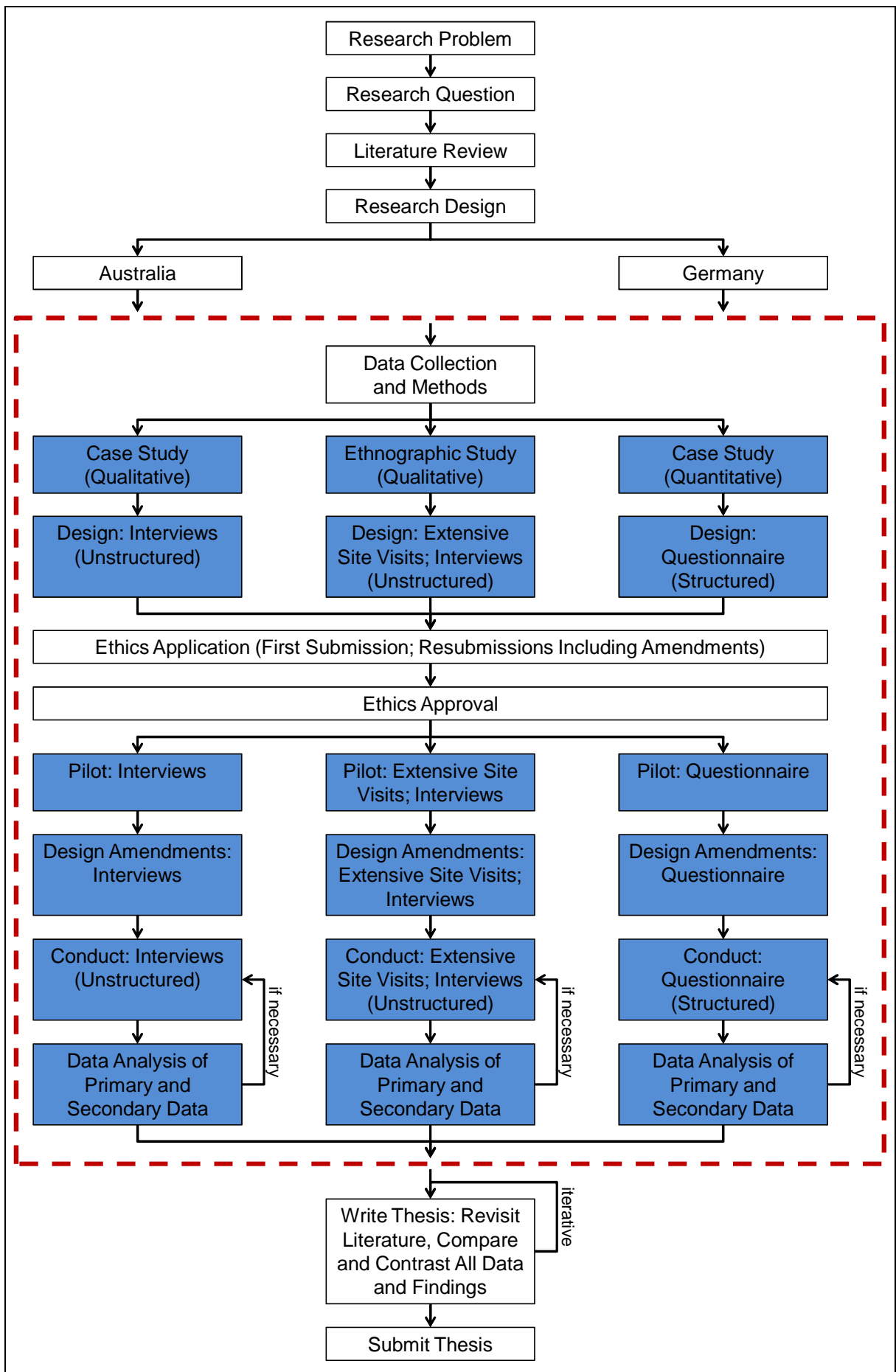
Figure 22: Flow diagram of the research
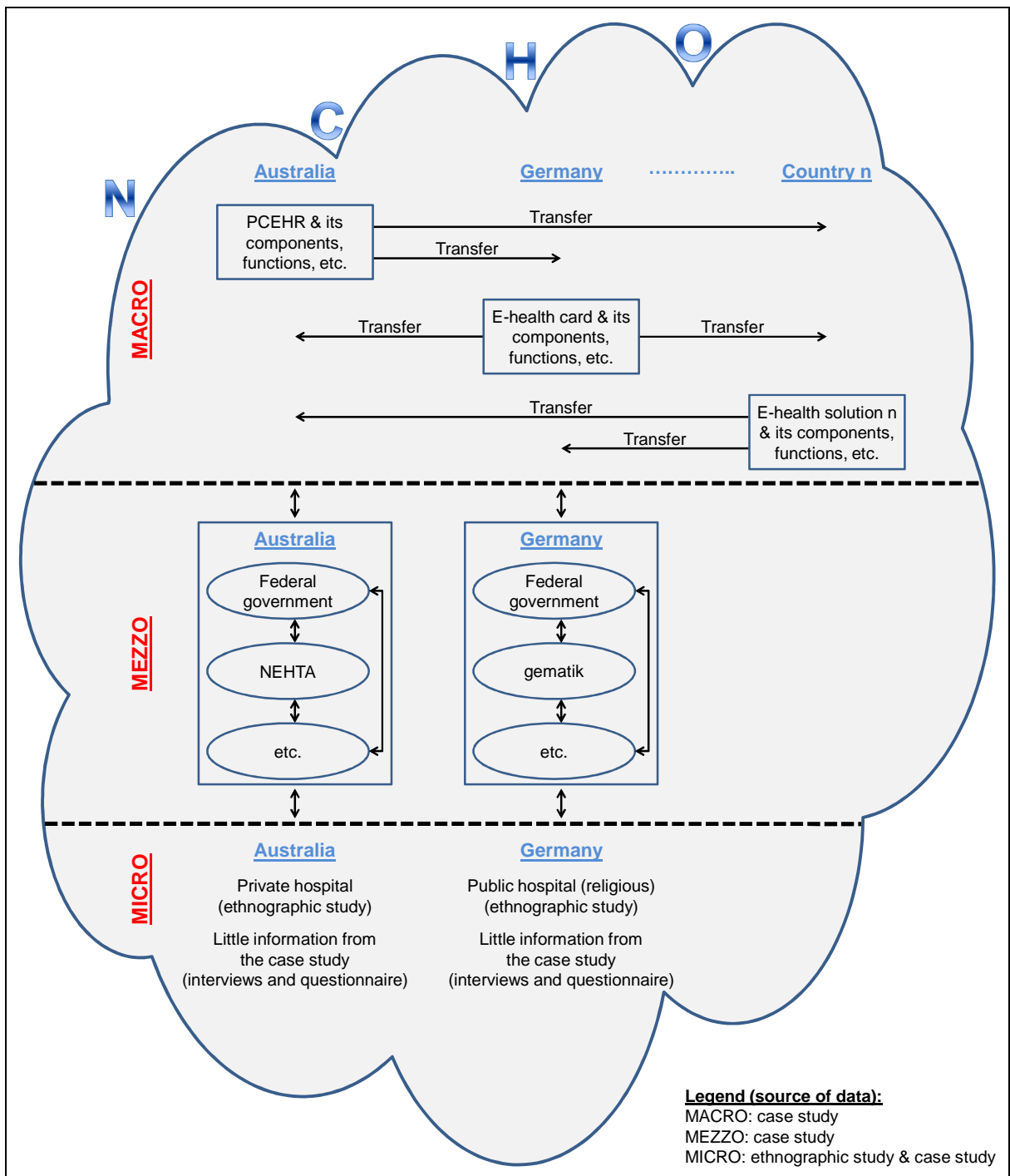
Figure 23: Conceptual framework showing the micro, mezzo and macro views of the study

It should be mentioned that a transfer of a national e-health solution is not limited to the Australian national e-health solution and the German national e-health solution. Therefore, figure 23 highlights in the macro view an extension to multiple countries. However, this extension is not considered in the mezzo and micro view. The reason is that the flow goes in both directions, namely bottom-up and top-down. Data collection however was only conducted in Australia and Germany and therefore conclusions out of the micro and mezzo view (bottom-up) are limited to these two countries. If an own development and

implementation of a national e-health solution or a transfer of a national e-health solution from one country to another country is conducted, the top-down approach can be considered for several countries. However, given this situation and to be consistent, the mezzo and micro view is not showing a restricted focus on only a top-down flow.

Further, it should be noticed that this study defines network centric healthcare on a global scale including all countries. A successful transfer of one national e-health solution to other countries involving all three views (micro, mezzo and macro) can lead to a global e-health solution. In other words this can allow network centric healthcare operations (NCHO), which is illustrated in figure 23.

3.2.1 Case Study

This section describes why case study is the appropriate method for conducting this study followed by a definition of case study. This section also illustrates further necessary considerations and decisions by the researcher.

Based on Yin, there are three aspects which need to be considered in order to identify the appropriate method: "(a) the type of research question posed, (b) the extent of control an investigator has over actual behavioral events, and (c) the degree of focus on contemporary as opposed to historical events" (Yin 2009, p. 8).

The following table 6 shows necessary conditions for different research methods. Based on this table, it is possible to identify the adequate method for conducting the research.

METHOD	Form of Research Question	Requires Control of Behavioral Events?	Focuses on Contemporary Events?
Experiment	how, why?	yes	yes
Survey	who, what, where, how many, how much?	no	yes
Archival Analysis	who, what, where, how many, how much?	no	yes/no
History	how, why?	no	no
Case Study	how, why?	no	yes

Table 6: Relevant situations for different research methods (adapted from Yin 2009)

Based on Yin, "how" and "why" research questions "are more *explanatory* and likely to lead to the use of case studies, histories, and experiments as the preferred research methods. This is because such questions deal with operational links needing to be traced over time, rather than mere frequencies or incidence" (Yin 2009, p. 9). Because the research question of this study is a "how" research question, only "Experiment", "History" and "Case Study" are appropriate methods and therefore evaluated in further steps.

Experiment is the appropriate method in conducting research, when the researcher "can manipulate behavior directly, precisely, and systematically" (Yin 2009, p. 11). Thereby, this method focuses on contemporary events (Yin 2009).

History is the appropriate method in situations, where "there is virtually no access or control" (Yin 2009, p. 11). This method is typically focused on the past (Yin 2009). However, contemporary events can be also investigated with the aid of the history method (Yin 2009).

Case study is the adequate method for investigating contemporary events; however, the manipulation of relevant behaviors is impossible (Yin 2009). This separates the case study method from the experiment method. Compared to the history method, the case study approach has two sources of evidence available (interviews with people and direct observations), which are normally not available in the historian context (Yin 2009).

Based on the fact that this study investigates a "how" research question, is focused on a new evolving area with current relevance (i.e. contemporary events) and relevant behaviors cannot be manipulated directly, precisely, and systematically by the researcher, the case study approach is the appropriate method for conducting this research.

Based on Yin's definition, a "case study is an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context" (Yin 2009, p. 18). This is in particular adequate, "when the boundaries between phenomenon and context are not clearly evident" (Yin 2009, p. 18).

Furthermore, Yin states that the case study method overcomes with situations, where there are "more variables of interest than data points" (Yin 2009, p. 18). Therefore, the case study inquiry "relies on multiple sources of evidence, with data needing to converge in a triangulation fashion" (Yin 2009, p. 18) and profits from prior theories in order to "guide data collection and analysis" (Yin 2009, p. 18).

Based on the purpose of a study, three different types of research can be differentiated: explanatory, exploratory and descriptive research (Durrheim 2006; Richey and Klein 2007). Explanatory research has the goal "to provide causal explanations of phenomena" (Durrheim 2006, p. 44). Exploratory research is applied to get prior explorations about research topics, where there is little knowledge, with the goal to learn more about phenomena (Durrheim 2006). Descriptive research has the goal to describe phenomena precisely (Durrheim 2006).

The case study method can be used for all three kinds of research and therefore depending on the purpose of the study explanatory, exploratory or descriptive case studies are appropriate (Yin 2009). As the literature review has shown, there is only little knowledge about the research topic itself. Therefore, this study is classified as exploratory research using case study as main data collection method.

To determine the case study as the appropriate method for this exploratory study is the first step. However, in the second step, the researcher has to define the case study design. This research conducts a case study in Australia and a case study in Germany. Each case study is conducted as a unique respectively an exemplar case study, because Australia and Germany have different settings and each case study supports this exploratory research by getting first insights in a quite new and unknown research area. Using the case study method as a unique case study respectively an exemplar case study is appropriate and has been successfully proven in previous studies (Markus 1983; Wickramasinghe 1999; Yin 2009; Sulaiman 2011).

By using the case study method a common concern is the question of generalization from case studies to theory (Yin 2009). Yin separates generalization into statistical and analytic generalization (Yin 2009). Thereby, he states that for case studies "the mode of generalization is *analytic* generalization, in which a previously developed theory is used as a template with which to compare the empirical results of the case study" (Yin 2009, p. 38).

Case study research is normally focused on qualitative data; however, multiple methods for qualitative and quantitative evidence can be used (Johnson and Christensen 2008; Yin 2009). In this way, case studies can include quantitative data in extensive quantity (Yin 2009). Yin states that if "these data are subjected to statistical analyses at the same time that qualitative data nevertheless remain central to the entire case study, you will have successfully followed a strong analytic strategy" (Yin 2009, p. 132). The application of multiple methods of data collection allows triangulation, which "provides stronger substantiation of constructs and hypotheses" (Eisenhardt 1989, p. 538). In other words the application of multiple sources of evidence allows "the development of *converging lines of inquiry*, a process of triangulation

and corroboration" (Yin 2009, p. 115-116). Further details about triangulation are given in section 3.2.5.1.

The case study in Australia and the case study in Germany are primarily based on interviews, but also supported by a questionnaire. Both data collection methods are described in following subsections 3.2.1.1 and 3.2.1.2.

3.2.1.1 Interviews

Interviews are frequently used in case studies (Kvale 1996; Yin 2009). They are a very essential tool to get detailed information, opinions, etc., from different people about events (Yin 2009).

Interviews can be conducted face to face (also called in-person interviews) or via telephone (Johnson and Christensen 2008). Alternatively, the interview can be done via email (Meho 2006). However, it should be mentioned that in case of an email interview, there is no direct interaction possible and therefore further emails or call backs can be necessary (Meho 2006). Moreover, the interview can be done via paper, where the interview protocol is forwarded to the informant. Paper-based interviews are also confronted with the lack of direct interaction.

Before interviews can be conducted, it is important that the researcher defines the intended and appropriate type of interview. There exist several types of interviews. The interview types differ among others in names, characteristics and/or proceedings. The interview types and their differentiations are also varying, depending on the author. For example, some authors distinguish interviews between the two extremes, unstructured and structured interviews (Kothari 2004; Taylor et al. 2006), while others distinguish interviews between unstructured, semi-structured and structured interviews (Fontana and Frey 2005; Bernard 2006; Bless et al. 2006; Lodico et al. 2010; Srivastava and Rego 2011). This study differentiates between unstructured, semi-structured and structured interviews, because it does not limit the options between two extremes.

In **unstructured interviews** the researcher has the highest flexibility in conducting the interview, because the style is more focused on a conversation (Lodico et al. 2010). Thereby, the researcher works through a specific list of topics, uses some open-ended questions in the beginning and navigates the interview flow depending on the interviewee's answers (Lodico et al. 2010).

Semi-structured interviews are positioned between unstructured and structured interviews. For conducting the interview, the researcher uses an interview protocol including header, questions and/or topics, which is used for all interviewees (Lodico et al. 2010). During the interview, the researcher can skip and add questions and can change the wording or flow of questions (Lodico et al. 2010). However, in semi-structured interviews date, time and topics are known beforehand (Lodico et al. 2010). Semi-structured interviews differ primarily from unstructured interviews in the extent of planning and preparation in advance (Lodico et al. 2010).

Structured interviews expect from the researcher that all participants will be asked the same questions without deviation and therefore there is no flexibility (Lodico et al. 2010).

The case study in Australia and the case study in Germany use unstructured interviews as the main data collection method. One reason is that unstructured interviews are appropriate for exploratory research (Kothari 2004; Bless et al. 2006; Taylor et al. 2006; Srivastava and Rego 2011). This is also supported by Kvale, who says that exploratory interviews have marginally structure and they are open (Kvale 1996). Additionally, it is expected that the background, knowledge, experience, etc., are different across the different e-health stakeholders in Australia and Germany. Therefore, it is essential to use unstructured interviews as they give the researcher the highest level of flexibility to adapt each interview. Thereby, specific circumstances such as interviewee´s knowledge, answers and time, which cannot be foreseen in advance, can be considered and adaptations can be made. The flexibility fits again with Kvale, because for him one quality aspect of an interview is the "degree to which the interviewer follows up and clarifies the meanings of the relevant aspects of the answers" (Kvale 1996, p. 145).

In order to guarantee the focus on the research question, to increase reliability and comparableness of answers, and the possibility for conducting email and/or paper-based interviews, the researcher has developed an interview protocol (see appendix 1). Based on the research question, its supporting questions and the literature review, this protocol includes relevant topics and several optional open-ended questions.

The case study in Australia involved 32 interviews with different Australian e-health stakeholders aged over 18 years. The case study in Germany involved 36 interviews with different German e-health stakeholders aged over 18 years. The priority in both countries was to conduct the interviews face to face. However, due to several circumstances like distance,

interviewee's flexibility and limited time, it was also necessary to conduct interviews via telephone, email and paper.

All interviewees in Australia and Germany were asked for permission either by using the prepared consent form, by giving permission over the telephone or by giving permission through receiving the completed email or paper-based interview. Furthermore, the researcher has developed a plain language statement, which explains the research, the research question, etc. This statement was distributed to the specific interviewee, if necessary. The necessary ethics standards are considered (see section 3.2.3) and all data are handled anonymous by using codes. Because some interviews had to be conducted in German, the interview protocol was translated into German and the German interview findings into English. The translation of the English interview protocol into German and some translated samples of the findings were checked by an appropriate expert of the languages and the topic area.

During the development of the interview protocol, the researcher has discussed the topics and the listed open-ended questions with four different test persons. The intension was to guarantee appropriate design and understanding of the interview protocol. Furthermore, because data collection was started in Australia, the researcher has conducted the first interviews in Australia as a "pilot". Thereby, the researcher has realized that the usage of an audio tape recorder helps to guarantee the correctness and completeness of gained interview data (Yin 2009). It also helps the interviewer to focus more on the interview itself (Kvale 1996). Based on this experience, the researcher has started to record the interviews via audio tape, if the interviewee has given his/her permission. The results of the audio tapes were transcribed verbatim, wherever possible. The results of the interviews are presented in section 4.2.

3.2.1.2 Questionnaire

In addition to the interviews, a questionnaire was designed in order to include the opinion of the general public from Australia and Germany into the study. A questionnaire helps the researcher to "obtain information about the thoughts, feelings, attitudes, beliefs, values, perceptions, personality, and behavioral intentions of research participants" (Johnson and Christensen 2008, p. 170). Questionnaires can be either used alone or together with other data collection methods (Johnson and Christensen 2008).

A questionnaire can be based on open-ended questions, closed-ended questions or a combination of both kinds of questions (Johnson and Christensen 2008). While open-ended

questions allow the participants to answer the question by using own words, closed-ended questions requests from the participants to choose from a list of given answers (Johnson and Christensen 2008).

The questionnaire applied for the case study in Australia and the case study in Germany consists of closed-ended questions. The reason is that through this standardization procedure, quantitative data can be collected. As a result, frequencies across the general public can be calculated. These findings are important in order to discuss, validate or refuse the findings achieved from other data collection methods, which in this way allows triangulation (see section 3.2.5.1).

The case study in Australia involved 129 completed questionnaires. The case study in Germany also involved 129 completed questionnaires. In both countries, the selection criteria were that the participants are aged over 18 years and that they are citizens or at least permanent residents of the respective country, as these people have typically at least public health insurance. The participants were asked on the street for participation. As it turned out, the willingness for participation was quite low on the street. Therefore, the researcher has distributed some questionnaires via business colleagues, friends, etc.

The questionnaire consists of two sections (see appendix 2). The first section asks for general information about the respondent, such as gender and kind of health insurance program, which can later help to make group specific analysis and recommendations. The second section includes specific close-ended questions, where the possible answer is limited to pre-defined answers (e.g. "yes" or "no"), or where the respondent can choose the answer on a predefined scale. The results of the questionnaire are presented in section 4.3.

The researcher has also developed a plain language statement, which includes an explanation of the research, the research question, etc. This statement was distributed to the participants, if necessary. The necessary ethics standards are considered (see section 3.2.3). For Germany, it was also required to translate the English questionnaire into German, which was checked by an appropriate expert of the languages and the topic area.

Similar to the interviews, the questions of the questionnaire were discussed with four test persons, while designing the questionnaire. The intension was to guarantee appropriate design and understanding of the questionnaire. Additionally, because data collection was started in Australia, the researcher has conducted the first questionnaires in Australia as a "pilot". This pilot ensured an adequate feasibility of the questionnaire (Johnson and Christensen 2008).

However, no negative issues were mentioned and therefore all pilot questionnaires were considered.

3.2.2 Ethnographic Study

Ethnography is a qualitative method, which has its origin in anthropology (Johnson and Christensen 2008). Thereby, "ethnography is traditionally or classically defined as the discovery and comprehensive description of the culture of a group of people" (Johnson and Christensen 2008, p. 400).

In an ethnographic study, the researcher conducts extended fieldwork, which means that he/she goes into the field and studies the people within their environment (Johnson and Christensen 2008). Thereby, the researcher is an observer or a participant observer (Johnson and Christensen 2008).

The ethnographic study plays an important role for this research, because it is expected that different environments have an impact. Additionally, it is expected that the different cultures of the people influence the outcome of this research. In order to capture this aspect ethnographic research techniques are necessary.

In Australia, the researcher has performed fieldwork at a private hospital. This included a one day extensive site visit, the participation for several weeks in a project team, which was established to develop the hospital's e-health strategy and a one day surgery observation. To ensure that the ethnographic part of this research has been designed appropriately, the researcher has used the first extensive site visit (i.e. the one day extensive site visit) at the Australian private hospital as a "pilot".

In Germany, the researcher has performed fieldwork by working for three months at a public hospital, which is oriented on the Christian anthropology. Thereby, also observations were made.

The ethnographic study is essential to fully understand the Australian and German healthcare environment including the culture, behaviors and attitudes of healthcare actors (especially e-health stakeholders). Where validation of observed data and/or more detailed insights were necessary, the researcher has asked unstructured questions about observed events to appropriate hospital personnel by using unstructured interviews. The use of unstructured interviews is appropriate in ethnographic studies (Bernard 2006; DiCicco-Bloom and Crabtree 2006; Lodico et al. 2010), because through this procedure the "interviewer elicits information

about the meaning of observed behaviours, interactions, artefacts and rituals, with questions emerging over time" (DiCicco-Bloom and Crabtree 2006, p. 315). However, it is important to note that these unstructured interviews were conducted without an interview protocol.

The results of the ethnographic study in Australia and the ethnographic study in Germany are presented in section 4.4.

3.2.3 Ethics Application and Approval

Because the case study and ethnographic study in Australia and in Germany involve people, the researcher had to submit an ethics application to his academic institution (RMIT University). Together with the completed ethics application form, the researcher had to submit among others the intended interview protocol, the questionnaire, the consent form and the plain language statements. Based on requests from the RMIT University ethics committee for more detailed explanations and further documents, the researcher had to resubmit the ethics application twice, before final ethics approval was granted. The registered ethics application number at RMIT University is 1000322.

In Australia, the researcher has also submitted the required permission from the city of Melbourne for conducting the questionnaire on the street.

In Germany, the researcher got also the required permissions. Firstly, for the ethnographic study at the German public hospital, the researcher got approval from the hospital's chief of human resource regarding the working and observation procedure and the written down facts. Secondly, for conducting a questionnaire on the street, there exists no compulsory obligation to get permission from a city hall in Germany. This was confirmed to the researcher by the city hall of a chosen city. However, it should be noted that this simplified procedure only applies, if the researcher is a private person, the researcher does not tease anybody, the researcher only asks people in public places and finally the researcher does not use a booth. All these requirements are fulfilled.

The final ethics report, which confirms that the data collection is completed, was submitted to the RMIT University ethics committee as required.

3.2.4 Data Analysis

Data analysis is important in order to evaluate primary data, which are collected through the usage of different data collection methods in Australia and Germany. Further, secondary data

are analyzed. This is an iterative process and if necessary may require follow-up and/or revisits to check accuracy. Additionally, a cross-national data analysis is conducted for the different data collection methods.

The qualitative data from the case study interviews in Australia and the case study interviews in Germany are segmented by country and focus (national e-health solution, transfer and global e-health solution). The themes came from the research question, the literature review and the interview protocol on the one hand and through analyzing the collected data on the other hand. Thereby, thematic analysis is conducted as recommended (Kvale 1996; Boyatzis 1998). The findings are classified as expected findings and emerging findings. Further, the emerging themes are identified and stated. Based on these results, the significant findings are presented. Furthermore, the relationships between the different aspects are identified, tables are developed and the results are validated. Details of the thematic analysis are presented in section 4.2.1.

The quantitative data from the case study questionnaires in Australia and the case study questionnaires in Germany are evaluated by calculating frequencies. The frequencies are given in total and for different groups. The clustering of groups depends on factors like country, gender and age. As the questions are closed-ended questions, the possibility for quantitative statistical analysis is given (Johnson and Christensen 2008).

The findings of the ethnographic study conducted at an Australian hospital and at a German hospital are presented for each country. The findings are grouped and appropriate headings are determined. Based on these results, the implications including the similarities and differences between the Australian hospital and German hospital are worked out. In this context, it is important to note that the ethnographic study handles the different data collection methods used as one method and therefore the findings are assigned to the ethnographic study directly. There is one main reason. The interviews are used in this context differently. They are only conducted if necessary and if so, they serve to validate the observations and/or to get more detailed insights. However, they are not used to obtain independent results for a comparison. Therefore, in each stage of the ethnographic study, the data were collected in one flow. Consequently, in each stage, the data are closely linked and several overlaps exist. This circumstance prevents that the data received from the different data collection methods can be treated separately per method.

During the data analysis, it is also important to look at the different perspectives (micro, mezzo and macro) and to assign the findings to the respective view/views. Additionally, it is

also essential to consider triangulation (see section 3.2.5.1). This procedure increases the validity of data and consequently the validity of the study. The results of the data analyses are presented in the respective subsection of chapter 4.

3.2.5 Validity of Data

A very essential part of successful research is to ensure the validity of data and in this way the validity of the study. Campbell and Stanley differentiate between internal validity (i.e. interpretability) and external validity (i.e. generalizability) (Campbell and Stanley 1963). Therefore, the researcher of this study follows several steps in order to guarantee and to increase the internal validity and the external validity.

Subsection 3.2.5.1 explains how triangulation is considered in this study. Subsection 3.2.5.2 mentions additional steps accomplished.

3.2.5.1 Triangulation

A key procedure for increasing the validity of this study is triangulation. "Triangulation means that researchers take different perspectives on an issue under study or – more generally speaking – in answering research questions" (Flick 2009, p. 445). Triangulation can be distinguished between four fundamental types: data triangulation, investigator triangulation, theory triangulation and methodological triangulation (Denzin 2009).

Data triangulation is focused on the inclusion of different data sources (Denzin 2009). Data triangulation consists in turn of three types: time, space and person (Denzin 2009). In addition, Denzin separates "person" in three levels: aggregate, interactive and collectivity (Denzin 2009). Thereby, aggregate means "at the level of the individual" (Arksey and Knight 1999, p. 23), interactive means "at the level of interacting individuals, such as families or small groups" (Arksey and Knight 1999, p. 23) and collectivity means "at the level of organizations, groups or communities" (Arksey and Knight 1999, p. 23). Data triangulation is applied in this study, because each data collection method used in Australia and Germany includes different dates (time), different locations (space) and different participants (person). The unstructured interviews (case study and ethnographic study in Australia and Germany) and the questionnaire are focused on the aggregate level as each interview and each questionnaire is conducted with a specific person. The extensive site visits at hospitals of both countries including observations and participant observations are based on all three levels depending on dates, locations and participants.

Investigator triangulation differentiates between one and more "observers" looking for the same object (Denzin 2009). However, investigator triangulation is not applied in this study, because this study involves only one investigator, i.e. the researcher itself.

Theory triangulation differentiates between one and more theories respective perspectives for the same object in mind (Denzin 2009). However, theory triangulation is not applied in this study, because the theory bear in mind for conducting this study is network centric healthcare.

Methodological triangulation can be differentiated among "within-method" and "between-method" triangulation (Denzin 2009). Within-method triangulation is achieved, when several techniques are applied within one method and thereby the same object/item/variable is targeted (Arksey and Knight 1999). Between-method triangulation is achieved, when several methods are applied in the research of the same object/item/variable (Arksey and Knight 1999). Methodological triangulation is realized in this study in both ways. Within-method triangulation is e.g. accomplished in each ethnographic study, as during the extensive site visits, the researcher has sometimes asked unstructured questions about observed facts. Between-method triangulation is realized, because this study applies multiple methods (mixed research). The case study and ethnographic study methods are used. Thereby, the unstructured interviews and extensive site visits produce qualitative data, while the questionnaire produces quantitative data. It is important to note that triangulation traditionally refers to between-method triangulation, because it "is conventionally assumed that triangulation is the use of multiple methods in the study of the same object" (Denzin 2009, p. 301).

Furthermore, triangulation can be also applied in the data analysis process, known as **triangulation in analyzing data** (Flick 2009). Thereby, this can be conducted in three different ways. Firstly, (same) data are analyzed with support of more than one method (Flick 2009). Secondly, because data received from different data collection methods have different characteristics, each data set is analyzed with a different method (Flick 2009). Thirdly, data are analyzed by connecting the data obtained from the different data collection methods in a whole analysis (Flick 2009). This can be done on the basis of a single case (e.g. a single specific participant) or on the basis of data sets (Flick 2009). Thereby, both alternatives are separately analyzing the data received from the different data collection methods (Flick 2009). Afterwards, the findings are analyzed overall by making a comparison (Flick 2009). The findings can complement, contradict or converge with each other (Flick 2009). It is essential to get explanations for the identified differences and to get along with this new knowledge

with respect to the study and its research question (Flick 2009). This study uses triangulation in analyzing data. In the first step, the different data characteristics are considered as a result of the diverse data collection methods. Therefore, each data set is analyzed with an appropriate method. In the second step, this study makes a comparison across the findings. The identified similarities and differences are further discussed and evaluated to answer the research question. All these procedures are very important for this study, because the different data collection methods do not refer to exactly the same perspectives of the study (micro, mezzo and macro). This issue was already shown in figure 23.

Denzin defines **multiple triangulation** as the application of data triangulation, investigator triangulation, theory triangulation and methodological triangulation within one research (Denzin 2009). However, as already explained and also shown in table 7, this research uses data triangulation, methodological triangulation and triangulation in analyzing data.

Type of triangulation			Fulfilled in this study
Data triangulation	Time		✓
	Space		✓
	Person	Aggregate	✓
		Interactive	✓
		Collectivity	✓
Investigator triangulation			✗
Theory triangulation			✗
Methodological triangulation	Within-method		✓
	Between-method		✓
Triangulation in analyzing data	(Same) data are analyzed with support of more than one method		✗
	Each data set is analyzed with a different method		✗
	Data are analyzed by connecting the data obtained from the different data collection methods in a whole analysis (first, the data are analyzed separately and then the findings overall by making a comparison)	Single case	✗
		Data sets	✓

Table 7: Overview of triangulation types applied in this study

Based on this fact, this research does not apply multiple triangulation as defined by Denzin. However, because firstly Denzin's triangulation types are extended by triangulation in analyzing data and secondly different types of triangulation are used in this research, this research uses also multiple triangulation, but defined differently. Overall, triangulation increases the validity of data and therefore the validity of the study.

3.2.5.2 Further Procedures for Increasing the Validity of Data

This study uses secondary data, which are analyzed by using archival techniques and which can be used together with other data for corroboration (Johnson and Christensen 2008). In this way, this increases the validity of data.

Furthermore, the researcher has contacted research participants again and/or has conducted revisits, when it was necessary, possible and allowed. The reasons for these procedures are to collect further data and/or to get answers to questions, which came up during the analysis of the data gained. This ensures the completeness of data, but also the correctness of data interpretation.

As already mentioned, some interviews were conducted in German and therefore translations are required. In order to increase validity of data, the researcher has forwarded some translated samples of the findings to an appropriate expert of the languages and the topic area.

3.3 Summary

Firstly, this chapter has presented the research methodology used for this exploratory study. As stated, this study uses a mixed research approach. Thereby, an exemplar case study in Australia and an exemplar case study in Germany are conducted. The case study in Australia and the case study in Germany involve unstructured interviews and a questionnaire, including closed-ended questions. In addition, this research further conducts an ethnographic study in both countries.

Secondly, this chapter has presented the research design used for this study. In this way, this chapter has illustrated the research design flow diagram and has given the context of the micro, mezzo and macro view. Moreover, an overview of the ethics approval procedure was given. Finally, details about the data analysis procedures and the validity of data were mentioned.

CHAPTER 4

4. Data Analysis and Findings

Firstly, this chapter presents the revised conceptual framework. Secondly, this chapter gives details about the case study interviews conducted in Australia and Germany. In this way, the data analysis procedure – namely thematic analysis – is explained. Further, the findings of the interviews are presented for both countries. They are structured as expected findings and emerging findings. Further, the emerging themes are identified and stated. Based on these results, the significant findings are derived. Thirdly, the results of the supporting questionnaire conducted in Australia and Germany are shown. Fourthly, the procedures of the ethnographic study in Australia and in Germany are explained and the findings are presented. Finally, a summary of this chapter is presented.

These findings are essential for the discussion including the triangulation of the findings in chapter 5 and for answering the research question and its supporting questions in chapter 6.

4.1 Revised Conceptual Framework

In this section, the revised conceptual framework is illustrated. Thereby, numbers are incorporated. These numbers help to assign the findings of the Australian interviews, the German interviews, the Australian questionnaires, the German questionnaires, the ethnographic study in Australia and the ethnographic study in Germany to the specific views of the study. If all the findings are included in the conceptual framework directly, this figure will be very unclear.

While the findings about the Australian national e-health solution refer to number one, the findings about the German national e-health solution refer to number two. In this context, the findings of the case study relate to the micro, mezzo and macro view of the study, while the findings of the ethnographic study in Australia and the ethnographic study of Germany only affect the micro view. The results, which focus on the transfer of a national e-health solution, relate to number three and in this way only to the macro view. Further, the findings about a global e-health solution respectively network centric healthcare operations (NCHO) refer to number four.

The link to the revised conceptual framework is given in the following sections, before, while or after the findings are presented. As a consequence, the link is mentioned at the certain place as "(see section 4.1, figure 24, no. X)", whereby "X" stands for the specific number.
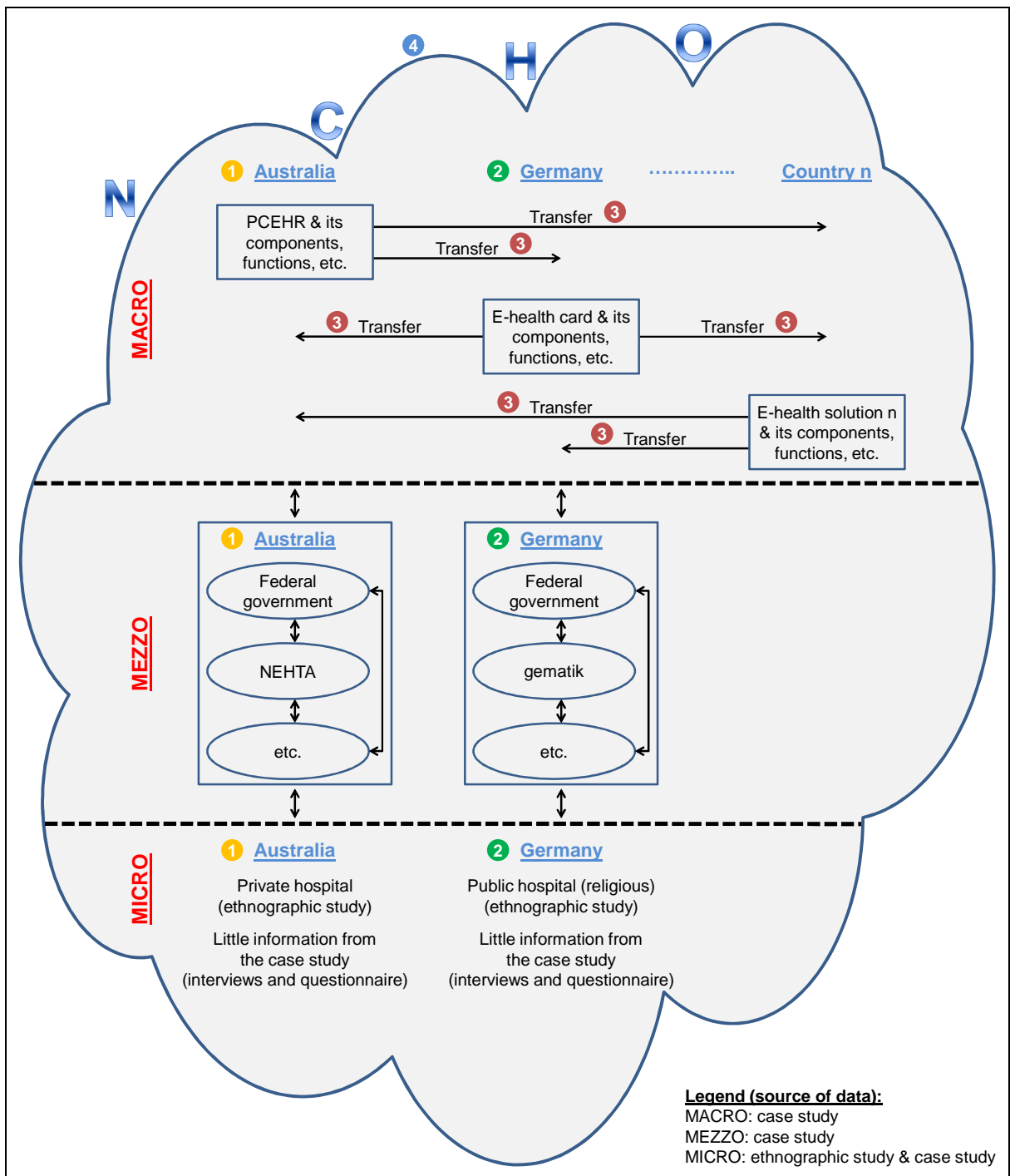
Figure 24: Revised conceptual framework

4.2 Interviews

As part of the case study in Australia and Germany, this study has conducted unstructured interviews with different e-health stakeholders in both countries. In order to increase among others the reliability, an interview protocol was used (see appendix 1).

The following table 8 shows the details about the 32 Australian interviews, which were conducted. Table 9 gives an overview of the 36 German interviews, which were conducted. In this way, both tables mention details about the affiliation of each interviewee as well as his/her area of work/position. It is important to note that all data are processed anonymous and therefore minor adaptations in form of simplifications were necessary for both tables. Further, in both tables for each interviewee a code was developed, which is used to present verbatim statements. Each code consists of three components. The first part of the code gives details about the country, where the interview was conducted – an "A" stands for Australia and a "G" typifies Germany. The second part of the code relates to the interviewee's affiliation. The third part of the code gives details about the area of work/position.

Code	Affiliation	Area of work/position
[A-SG-M]	State government	Senior project officer
[A-VHAL-M]	Victorian Healthcare Association Limited	Research & policy
[A-EHIO-EH1]	E-health institution/organization (NEHTA)	E-health expert
[A-EHIO-EH2]	E-health institution/organization (NEHTA)	E-health expert
[A-GD-M]	Giesecke & Devrient	Business development manager
[A-GD-IT1]	Giesecke & Devrient	IT expert
[A-GD-IT2]	Giesecke & Devrient	IT expert
[A-PUH-IT]	Public hospital	Health IT database specialist
[A-PUH-N]	Public hospital	Nurse
[A-PUH-D]	Public hospital	Doctor
[A-PRH-IT1]	Private hospital	IT project manager
[A-PRH-IT2]	Private hospital	IT project manager
[A-PRH-IT3]	Private hospital	Clinical informatics specialist
[A-PRH-IT4/N]	Private hospital	Clinical information officer; nurse
[A-PRH-D1]	Private hospital	Doctor
[A-PRH-D2]	Private hospital	Doctor
[A-PRH-D3]	Private hospital	Doctor
[A-MPP1-D]	Medical practice for physicians	Doctor
[A-MPP2-D]	Medical practice for physicians	Doctor
[A-MPDE-DE]	Medical practice for dentists	Dentist
[A-P1-P]	Pharmacy	Pharmacist
[A-P2-P]	Pharmacy	Pharmacist
[A-PRHIC-IT]	Private health insurance company	IT manager
[A-U1-SN]	University	Student (nurse)
[A-U2-AIT/D]	University	Academic (IT); doctor
[A-U3-ABIT1]	University	Academic (business and IT)
[A-U3-ABIT2]	University	Academic (business and IT)
[A-U3-ABIT3]	University	Academic (business and IT)
[A-U3-SBIT1]	University	Student (business and IT)
[A-U3-SBIT2]	University	Student (business and IT)
[A-U3-SBIT3]	University	Student (business and IT)
[A-PE-E]	Pensioner	Enrollee

Table 8: List of the Australian interviews
[It should be noted that the order is based first of all on the affiliation and second on the area of work/position.]

Code	Affiliation	Area of work/position
[G-FG-ME1]	Former federal government; to date: Bundestag (national Parliament of the Federal Republic of Germany)	Member
[G-FG-ME2]	Former federal government; to date: Bundestag (national Parliament of the Federal Republic of Germany)	Member
[G-C1-C]	Consultancy; Nordwürttemberg CDU (party)	Consultant (strategic management); member of the party
[G-EHIO-IT]	E-health institution/organization (gematik)	IT expert
[G-AN1-AN]	Anonymous (one of the head organizations in healthcare)	Anonymous
[G-AN2-EH]	Anonymous (federal association)	Anonymous (e-health expert)
[G-IBM-C]	IBM Deutschland GmbH	Former position: working as IBM consultant among other things for the federal ministry of health, head organizations of self-government in healthcare and gematik; to date: IBM consultant (e-health)
[G-C2-C]	Consultancy	Consultant (main focus on IT supported process management at public health insurance companies)
[G-GD-M1]	Giesecke & Devrient	Sales subsidiaries
[G-GD-M2]	Giesecke & Devrient	Product management
[G-H-IT]	Hospital (religious)	IT expert; IT risk management
[G-PUH1-IT]	Public hospital (university)	IT expert; project management
[G-PUH2-M]	Public hospital (religious)	Human resources
[G-PUH2-IT]	Public hospital (religious)	Network and system management
[G-PUH2-D1]	Public hospital (religious)	Doctor
[G-PUH2-D2]	Public hospital (religious)	Doctor
[G-PUH2-D3]	Public hospital (religious)	Doctor
[G-PUH3-IT]	Public hospital	Medical technology, IT and organization
[G-PUH3-N1]	Public hospital	Nurse
[G-PUH3-N2]	Public hospital	Nurse
[G-PRH-N]	Private hospital	Nurse
[G-MPP-D]	Medical practice for physicians	Doctor
[G-MPDE1-DE]	Medical practice for dentists	Dentist
[G-MPDE2-DE]	Medical practice for dentists	Dentist
[G-P1-P]	Pharmacy	Pharmacist
[G-P2-P]	Pharmacy	Pharmacist
[G-PUHIC1-IT]	Public health insurance company	Software architect
[G-PUHIC2-M]	Public health insurance company	Medicine price management/model projects
[G-PRHIC-IT]	Private health insurance company; university	Former position: application developer, software engineering (private health insurance company); to date: student (law)
[G-U1-ABIT]	University	Academic (business and IT)
[G-U2-ABHM]	University	Academic (business and health management)
[G-U3-AMKT]	University	Academic (marketing)
[G-C3-C]	Consultancy	Consultant (finance)
[G-PC-M]	Pharmaceutical company	Finance and controlling
[G-FI-M]	Financial institution	Process management
[G-SAG-M]	Siemens AG	Energy/power generation

Table 9: List of the German interviews
[The order is based first of all on the affiliation and second on the area of work/position. However, this procedure is not valid for the "consultancy" interviews, as they are sorted by their focus/second affiliation.]

At the end, it should be noted that in those codes, where a "M" is mentioned for area of work/position, this stands for management respectively manager in general.

4.2.1 Thematic Analysis

This study uses thematic analysis in order to analyze the qualitative data received from the unstructured interviews. The interview protocol, which was applied, is shown in appendix 1.

However, before the interview data can be analyzed, three preparations were required. Firstly, it was necessary to transcribe the available interview audio files. The researcher has forwarded most of the interview audio files to external transcribing services. The necessary instructions were given to them. Though, the researcher has transcribed especially the first interview audio file by himself. This process helped to identify problems, which can arise during transcription, as well as to improving the instructions, which are essential for the external transcribing services. The transcription of the interview audio files was done verbatim as closest as possible, but depending on the respective audio file quality. After receiving the transcribed interviews, the researcher has reviewed the transcribed texts. Secondly, the researcher had to transcribe the own notes of those face to face interviews, where audio tape was not allowed to use. Thirdly, the paper-based interview notes were transcribed by the researcher.

For conducting thematic analysis the researcher has to consider three different steps (Boyatzis 1998). In the first step, the researcher has to clarify the sampling and design matters (Boyatzis 1998). In the second step, the researcher has to develop the themes and the code (Boyatzis 1998). Thereby, Boyatzis mentions a continuum with "three different ways to develop a thematic code: (a) theory driven, (b) prior data or prior research driven, and (c) inductive (i.e., from the raw data) or data driven" (Boyatzis 1998, p. 29). In the third step, the researcher is confronted with the validation and the usage of the code (Boyatzis 1998). While a "theme is a pattern found in the information that at minimum describes and organizes the possible observations and at maximum interprets aspects of the phenomenon" (Boyatzis 1998, p. 4), a code "may be a list of themes; a complex model with themes, indicators, and qualifications that are causally related; or something in between these two forms" (Boyatzis 1998, p. 4).

For building up the thematic code, this study uses firstly the prior research driven approach. In addition, the inductive approach is also applied. In detail, the themes coming from prior research are called a priori themes. Consequently, this means that the a priori themes came from the research question, the literature review and the interview protocol. The expected

findings and emerging findings are allocated to these a priori themes. In an additional step, the emerging themes are identified from material that could not be allocated to the a priori themes and are stated. Derived from these results, the significant findings are presented. In the following, the key definitions in this context are presented:

- Expected findings – findings that have been seen in the literature before, but perhaps in another context.

- Emerging findings – findings that have not been seen in the literature.

- Emerging theme – arises from emerging findings that could not be assigned to the a priori themes, namely 'key factor", "barrier" or "facilitator".

- Key factor – important issue that if absent is a "barrier" and if present is a "facilitator". However, only the issues are considered that apply to the whole solution, i.e. the specific national e-health solution, the transferability of e-health solutions or a global e-health solution.

- Barrier – some issue that would impede the national, transfer of, global e-health solution. However, only the issues are considered that apply to the whole solution, i.e. the specific national e-health solution, the transferability of e-health solutions or a global e-health solution.

- Facilitator – some issue that would help the national, transfer of, global e-health solution. However, only the issues are considered that apply to the whole solution, i.e. the specific national e-health solution, the transferability of e-health solutions or a global e-health solution.

Finally, because some interviews were conducted in German, translations are required. However, because the researcher is a German native speaker, the thematic analysis is conducted with the not translated interview data and then just the findings are translated into English. This includes also the interview statements used for discussion. The German interviewees have often used local accents, when they answered the interview questions, which cannot be translated into English. In addition, because of these two different languages, a word-by-word translation approach can lead to falsified statements. Therefore, minor translation adjustments and restructures of the sentences are necessary by the researcher. However, in order to guarantee validity of the data, the researcher has forwarded some translated samples of the findings to an appropriate expert of the languages and the topic area.

4.2.2 Findings

This section presents the results of the Australian and German interviews. Firstly, the expected findings, emerging findings and emerging themes are presented for each focus (i.e. national, transfer, global) in a separate table. Within each table, the expected findings and emerging findings are separated for each country and are assigned to the a priori themes. Secondly, the significant findings are identified and mentioned. It should be noted that direct quotes of the interviews are only used in section 5.1, where the discussion of the interview results is conducted.

4.2.2.1 Expected Findings, Emerging Findings and Emerging Themes

In this section, the expected findings, emerging findings and emerging themes are presented for each focus (i.e. national, transfer, global). In order to structure them, tables are used. Because the results refer to different views of the revised conceptual framework (see section 4.1, figure 24), each table has a description below, which gives details about this issue.

In order to identify the key results, several steps are conducted. In the first step, for each focus (i.e. national, transfer and global), the expected findings and emerging findings are allocated to the respective table and the specific a priori theme. The results are separated between the Australian interview findings and the German interview findings. If the findings could not be assigned to the a priori themes, they are deferred as emerging findings for further analyses regarding emerging themes. In addition, for each finding a specific number is counted, which indicates the number of interviewees, who mentioned this expected or emerging finding. In the second step, where necessary, possible and reasonable, the findings are further grouped. In the third step, based on the numbers carried along, the most common findings are selected and presented for each field of the tables. In the fourth step, the numbers are removed and replaced by frequency groups. Thereby, findings, which have a number between "one" and "five" are highlighted with a "+", while findings which provide a number between "six" and "ten" are provided with "++". Further, findings having a number of "11" and more are assigned with "+++". In this context, it should be noted that findings relating to the same frequency group are ordered by presenting the most mentioned finding on the top, while the other findings of this frequency group are mentioned underneath corresponding to their appearance. In the fifth step, the presented expected findings and the emerging findings are examined for their relevance to the three domains of network centric healthcare, namely the

physical domain (process), the information domain (technology) and the cognitive domain (people). Finally, the emerging themes are identified and presented in each table.

During the thematic analysis, following key decisions are made:

- Generally, for each focus – national, transfer and global – the same findings provided by an interviewee are only counted once. Though, if an interviewee mentions an issue in several ways, namely as a key factor, a barrier and/or a facilitator, each of them are counted.

- If an interviewee has obviously mistaken the national e-health solution with the e-health solution of his/her affiliation, has misunderstood what the transferability of national e-health solutions means (e.g. the interviewee speaks about interoperability between two own developed national e-health solutions) or has misinterpret a global e-health solution (e.g. the interviewee speaks about different national e-health solutions using an interface or focuses only on some countries), the corresponding answers to this specific topic are not considered for analysis. However, if this misunderstanding only appears in some questions/question parts of the specific topic, then only these specific questions/question parts are ignored for analysis. Further, if an interviewee mentions in a specific question that he/she has no idea or something similar, his/her further statement(s) to that particular question are not considered consequently. In addition, if an answer is not clearly mentioned or cannot be clearly assigned, the answer is not included in the analysis.

- Content, which does not contribute to answer the research question or which does not produce useable/clear data, is not incorporated into the analysis. Based on the interview protocol, this means the section of general/demography/background. This information was only used for developing the tables, which give an overview of the interviewees. Further, the table with the national e-health functions and its corresponding follow-up questions and question 4.1 (federal government or the e-health institutions/organizations: most influence on the success of the e-health solution) and question 4.3 (impact of the federal government and the e-health institutions/organizations on the e-health solution success) including its follow-up questions are also not considered. Moreover, question 5.3 (SWOT) and question 5.4 (advantages and disadvantages for different e-health stakeholders) are not included as they are too far reaching, because they already assume a global e-health solution. Finally, the section of working environment is not incorporated.

- The data details achieved through question 2.6 (rural areas), question 5.5 (other industries) and question 6.7 (stakeholder with the biggest impact on the transferability of e-health solutions), do not produce findings for the a priori themes, but they are considered as potential emerging findings in the context of the identification of emerging themes.

- It should be noted that if an interviewee mentions in question 6.3 requirements for the transferability of e-health solutions and agrees that these requirements are also applicable for the realization of a global e-health solution, then those requirements are also allocated to table 12. However, only those requirements are assigned, which the interviewee has not mentioned already on another stage of the interview.

- The results regarding question 6.4 of the interview protocol – Which e-health functions, ideas and approaches do you think can be transferred across countries? – are given in the discussion (see section 5.1). As the answers vary across the different interviewees, a discussion is necessary. However, if issues could be applied to the a priori themes, these issues are added.

- In the transfer context, the interview protocol question 6.5 (SWOT) and question 6.6 (advantages and disadvantages for different e-health stakeholders) already assume a successful transfer of a national e-health solution from one country to another country. Therefore, the answers of the interviewees are separated and the results are presented in the discussion (section 5.1), as they are looking one step further in the future. In this context, it is important to note that the statements, which are not clearly assigned to strength, weaknesses, opportunities and threats, are not considered. Further, statements, which are not clearly allocated to the specific stakeholder or have obviously an incorrect perspective, are also not considered. However, the allocation of a statement to advantages or disadvantages is done by the researcher, if necessary. Moreover, as these questions assume a successful transfer of a national e-health solution, only these statements are considered, which also do so. This means that issues regarding e.g. the transfer including the implementation of a national e-health solution are not incorporated. Finally, it should be noted that some interviewees said that they see for these transfer questions the same answers as given for the global context, but adapted to the two countries perspective. In these cases, the researcher has used their global answers and has paraphrased them to the two country perspective. However, if this statement is not clearly given by the interviewee and the

researcher has repeated the noted global answers to the interviewee for checking, then only the confirmed answers are counted.

- Same, similar, equal, common, comparable and harmonization are handled as synonyms, while analyzing the data and presenting the results.

- Laws, regulations and policies are treated as synonyms.

- The results for the transferability context are generally not split between the transferring country and receiving country.

- Overall, it should be noted that the researcher has chosen a conservative approach for the analysis. This means that in critical cases the data were not considered.

Based on the steps conducted and decisions made, the following three tables could be developed. Firstly, table 10 presents the key results regarding the Australian national e-health solution and the German national e-health solution. Thereby, the expected findings and the emerging findings are allocated to the a priori themes, which are key factors, barriers and facilitators. Further, "special cases" could be identified as emerging theme.

Secondly, table 11 mentions the key results of the Australian interviews and the German interviews on the topic of the transferability of national e-health solutions. Again, the expected findings and the emerging findings are allocated to the a priori themes. As emerging theme, "environment" could be detected.

Thirdly, table 12 presents the key results of the Australian interviews and the German interviews on the subject of network centric healthcare respectively a global e-health solution. Once more, the expected findings and the emerging findings are allocated to the a priori themes. In this context, "knowledge/exemplars" could be determined.

It is important to note that the complete discussion of the three tables is conducted in section 5.1. This includes, among others, a comparison among the Australian and German interview results for each focus (i.e. national, transfer, global). In addition, the facilitators of each focus are generally checked regarding their potential to overcome the corresponding barriers. Furthermore, the emerging themes are evaluated and details are presented. Moreover, the findings of the different focuses are contrasted and discussed.

	Australian e-health solution		German e-health solution	
	Expected Findings	**Emerging Findings**	**Expected Findings**	**Emerging Findings**
Key Factors	• Ease of use (+) [PD; ID; CD] • Effectiveness (+) [PD; ID] • Correctness (+) [PD; ID] • Cost-benefit (+) [PD; ID]	NONE	• Acceptance (+) [CD] • Regulations regarding payment for equipment and infrastructure (+) [PD; ID; CD] • Cost benefit (+) [PD; ID] • Focus on better healthcare delivery, rather than on health expenditure (+) [PD; ID; CD]	NONE
Barriers	• Insufficient enlightenment of people (+++) [PD; CD] • Lack of data protection/ data security/privacy (++) [PD; ID; CD] • Amount of costs (++) [PD; ID; CD] • Lack of acceptance (++) [CD] • Insufficient involvement of the stakeholders (++) [PD; CD] • Resistance of stakeholders (+) [CD] • People's use (+) [PD; ID; CD]	• Inconsistency around legal aspects of health (federal government vs. states) (+) [PD; CD] • Change of government (+) [PD; CD] • Too many stakeholders involved (+) [PD; CD]	• Lack of data protection/ data security/privacy (+++) [PD; ID; CD] • Insufficient enlightenment of people (+++) [PD; CD] • Amount of costs (+++) [PD; CD] • Lack of acceptance (+++) [CD] • Insufficient involvement of the stakeholders (+++) [PD; CD] • Different interests/goals of stakeholders (++) [CD] • Lack of project planning (++) [PD; CD]	• Change of government (+) [PD; CD] • Too many stakeholders involved (+) [PD; CD] • Lobby groups (+) [PD; ID; CD]
Facilitators	• Enlightenment of people (+++) [PD; CD] • Bring the stakeholders on board (+++) [PD; CD] • Ensure data protection/ data security/privacy (++) [PD; ID; CD] • Training (+) [PD; ID; CD] • Use best practices (+) [PD; CD] • Step by step approach (+) [PD; ID; CD] • Build trust (+) [PD; CD]	• Consolidated law right across the nation in relation to health and privacy (+) [PD; CD] • More academic works to present benefits (+) [PD; CD]	• Enlightenment of people (+++) [PD; CD] • Ensure data protection/ data security/privacy (+++) [PD; ID; CD] • Bring the stakeholders on board (++) [PD; CD] • Create acceptance (++) [PD; CD] • Appropriate planning of the project (++) [PD; CD] • Use best practices (++) [PD; CD] • Training (+) [PD; ID; CD]	• Appropriate compensation system for healthcare providers or organizations (+) [PD; CD] • Restructure the complete concept, if problems during the implementation are too high (+) [PD; CD] • Define project goal across the major political parties (+) [PD; CD]
Emerging Themes	**SPECIAL CASES**			

Table 10: The key factors, barriers, facilitators and emerging themes influencing the success of the Australian and German national e-health solutions

[PD = physical domain (process); ID = information domain (technology); CD = cognitive domain (people). The findings refer to different views of the conceptual framework (see section 4.1, figure 24, no. 1-2). The findings regarding the Australian national e-health solution relate to no. 1 and come from the Australian interviews, while the findings regarding the German national e-health solution refer to no. 2 and come from the German interviews.]

	Australian Interviews		German Interviews	
	Expected Findings	**Emerging Findings**	**Expected Findings**	**Emerging Findings**
Key Factors	• Social/economic background (+) [PD; CD] • Government (+) [PD; CD] • Benefit of the solution (+) [PD; ID; CD] • Compatibility of the solution to different markets (+) [ID]	NONE	• Economic background (+) [PD; CD] • Scope of transfer (+) [PD; ID; CD] • Win-win situation for both countries (+) [PD; ID; CD] • Development stage (+) [PD; ID; CD]	NONE
Barriers	• Different cultures (+++) [PD; CD] • Different laws (++) [PD; CD] • Different technical preconditions (++) [PD; ID] • Different healthcare systems (+) [PD; ID; CD] • Different politics (+) [PD; CD] • Different standards of/ lack of data protection/ data security/privacy (+) [PD; ID; CD] • Different languages (+) [CD]	• Lack of evidence demonstrating impacts and benefits (+) [PD; ID; CD] • Different medical terminology (+) [PD; ID; CD] • Government's ability to make decisions (centralized vs. decentralized) (+) [PD; CD]	• Different healthcare systems (+++) [PD; ID; CD] • Different cultures (+++) [PD; CD] • Different languages (+++) [CD] • Different politics (++) [PD; CD] • Different interests (++) [PD; CD] • Different laws (++) [PD; CD] • Different technical preconditions (++) [PD; ID]	• Different medical standards (+) [PD; ID; CD] • Different medical terminology (+) [PD; ID; CD] • Different medicine catalogue (+) [PD; CD]
Facilitators	• Similar laws (+++) [PD; CD] • Similar healthcare systems (+++) [PD; ID; CD] • Similar IT infrastructure (+++) [PD; ID] • Similar culture (++) [PD; CD] • Similar objectives (+) [PD; CD] • Similar social/economic background (+) [PD; CD] • Same language (+) [CD]	• Local adaptations of the e-health solution must be possible (+) [PD; ID; CD] • Similar medical standards (+) [PD; ID; CD] • Similar medical terminology (+) [PD; ID; CD]	• Similar healthcare systems (+++) [PD; ID; CD] • Similar IT infrastructure (+++) [PD; ID] • Similar laws (+++) [PD; CD] • Same language (++) [CD] • Similar standards of/ ensure data protection/ data security/privacy (++) [PD; ID; CD] • Similar culture (+) [PD; CD] • Similar politics (+) [PD; CD]	• Local adaptations of the e-health solution must be possible (+) [PD; ID; CD] • Similar medical standards (+) [PD; ID; CD] • Cross-border workgroup/ institution, which handles the project realization (+) [PD; CD]
Emerging Themes	**ENVIRONMENT**			

Table 11: The key factors, barriers, facilitators and emerging themes influencing the transferability of national e-health solutions

[PD = physical domain (process); ID = information domain (technology); CD = cognitive domain (people). The findings refer to macro view of the conceptual framework, and thereby specifically to the transfer issue (see section 4.1, figure 24, no. 3).]

	Australian Interviews		German Interviews	
	Expected Findings	**Emerging Findings**	**Expected Findings**	**Emerging Findings**
Key Factors	• Information ownership (+) [PD; CD] • Policies (+) [PD; CD] • Public opinion (+) [CD] • Cost issues (+) [PD; CD]	• Medical terminologies across countries (+) [PD; ID; CD]	• Financial background (+) [PD; CD] • Technical realization (+) [PD; ID; CD] • Perception regarding benefits (+) [CD] • Language (+) [CD]	NONE
Barriers	• Different cultures (++) [PD; CD] • Different standards of/ lack of data protection/ data security/privacy (++) [PD; ID; CD] • Different languages (++) [CD] • Different politics (++) [PD; CD] • Different healthcare systems (++) [PD; ID; CD] • Different IT infrastructure (++) [PD; ID] • Scale of project (+) [PD; ID; CD]	• Lack of evidence demonstrating impacts and advantages (+) [PD; ID; CD]	• Different healthcare systems (+++) [PD; ID; CD] • Different languages (+++) [CD] • Different cultures (++) [PD; CD] • Different politics (++) [PD; CD] • Amount of costs (++) [PD; CD] • Different laws (++) [PD; CD] • Different IT infrastructure (++) [PD; ID]	• Different medical standards (+) [PD; ID; CD] • Different medical terminology (+) [PD; ID; CD] • Different medicine catalogue (+) [PD; CD] • Lack of an international umbrella organization for coordination (+) [PD; CD]
Facilitators	• Similar laws (++) [PD; CD] • Similar IT infrastructure (++) [PD; ID] • Get consent (++) [PD; CD] • Similar healthcare systems (+) [PD; ID; CD] • Proper governance/ leadership (+) [PD; CD] • Similar objectives (+) [PD; CD] • Step by step approach (+) [PD; ID; CD]	• Work through WHO/UN to get global acceptance (+) [PD; CD] • Global forum on e-health (+) [PD; ID; CD] • Similar e-health organization/authority (+) [PD; CD] • Similar medical standards (+) [PD; ID; CD]	• Similar healthcare systems (+++) [PD; ID; CD] • Similar laws (+++) [PD; CD] • Similar IT infrastructure (+++) [PD; ID] • Step by step approach (++) [PD; ID; CD] • Similar standards of/ ensure data protection/ data security/privacy (++) [PD; ID; CD] • Get consent (++) [PD; CD] • Same language (+) [CD]	• Global standard via WHO/UN (+) [PD; CD] • Similar medical standards (+) [PD; ID; CD] • Basic functionality for all countries with allowance of slightly local adaptations (+) [PD; ID; CD] • Financial support for poor countries (+) [PD; CD]
Emerging Themes	**KNOWLEDGE/EXEMPLARS**			

Table 12: The key factors, barriers, facilitators and emerging themes influencing the realization of network centric healthcare

[PD = physical domain (process); ID = information domain (technology); CD = cognitive domain (people). The findings refer to overall view of the conceptual framework (see section 4.1, figure 24, no. 4).]

4.2.2.2 Significant Findings

This section presents the significant findings of the Australian and German interviews. They are detected by looking on three aspects. Firstly, it is considered, how often a finding is mentioned within the specific focus and a priori theme on the Australian side or German side. Secondly, it is taken into account, if a finding occurs on the Australian side and German side. Thirdly, it is checked, whether a finding only appears at the national focus, transfer focus or global focus, or if the finding happens at several focuses. Based on all three aspects, following significant findings could be identified.

- Laws: finding shows overall a high frequency; happens on the Australian and German side; occurs at all three focuses (at the national focus, the statements are more specifically mentioned).

- Data security/data protection/privacy: finding shows overall a high frequency; happens on the Australian and German side; occurs at all three focuses.

- Healthcare systems: finding shows overall a high frequency; happens on the Australian and German side; occurs at the transfer focus and global focus.

- IT infrastructure: finding shows overall a high frequency; happens on the Australian and German side; occurs at the transfer focus and global focus.

- Culture: finding shows overall a medium frequency; happens on the Australian and German side; occurs at the transfer focus and global focus.

- Language: finding shows overall a medium frequency; happens on the Australian and German side; occurs at the transfer focus and global focus.

- Politics: finding shows overall a medium frequency; happens on the Australian and German side; occurs at the transfer focus and global focus.

- Medical standards: finding shows overall a low frequency; happens on the Australian and German side; occurs at the transfer focus and global focus.

At the end, it is important to emphasize again that the results, presented in section 4.2.2.1, already represent the key findings of a multiplicity of results.

4.3 Questionnaire

As part of the case study in Australia and Germany, this study has conducted a questionnaire in both countries (see appendix 2). The target group for the questionnaire was the general public. Specifically, the focus was on people, who are aged over 18 years and who are citizens or at least permanent residents of the respective country. The questionnaire includes a logical flow. This means that based on the respondent's answer, the respondent either has to stop the questionnaire, has to go to a specific next question or has to continue ordinary with the next following question. Therefore, the researcher has to consider this issue during the validation of a completed questionnaire.

In total, 129 completed Australian questionnaires and 129 completed German questionnaires were received. However, single data sets (participants) were deleted because of following reasons: participants disregard the logical flow of the questionnaire, made double answers within one question (where not allowed; which seems obviously wrong), and/or missed answers. After these necessary corrections, there are 97 completed questionnaires from Australia and 118 completed questionnaires from Germany available for data analysis.

In addition, for the completed Australian questionnaires, adjustments were made regarding their answers for "health insurance program". As already mentioned, every Australian or permanent resident has public health insurance by law. Because the questionnaire was only distributed to Australian citizens and permanent residents, all Australian participants should have at least public health insurance. However, this answer was only given in 40 of the 97 single data sets. Therefore, where necessary, public health insurance was added to the Australian participants. Furthermore, Australian participants have obviously misunderstood the difference between private health insurance and supplementary private health insurance. Private health insurance means here a substitutive function to public health insurance, which is not available in Australia. Therefore, all answers for private health insurance in Australia were shifted to/counted as supplementary private health insurance. In cases, where both types of private health insurance were answered, only the supplementary private health insurance was counted. A differentiation between supplementary and complementary was not made in the questionnaire.

4.3.1 Analysis

The analysis of the questionnaire data was done using Microsoft Excel. Thereby, the researcher has transferred all answers into a Microsoft Excel sheet and has used several functions of Microsoft Excel like the pivot table, filter and figures in order to achieve and illustrate the findings. It is important to note that the questionnaire has more a supporting function in this study, which means that the results are used primarily in order to confirm or decline the findings of the interviews and to discuss data presented in the literature review.

Due to the rejection of invalid questionnaires, there is a difference in the amount of valid data sets (participants) between Australia and Germany. Therefore, percentages instead of absolute figures are preferred. This allows a more appropriate comparison among the Australian and German findings. The percentages are rounded and no decimal places are given.

4.3.2 Findings

In the following, the findings of each questionnaire question are presented. The questionnaire is attached in appendix 2. As already mentioned, 97 completed questionnaires from Australia and 118 completed questionnaires from Germany are considered as valid. In total, this means that 215 questionnaires are used for analysis.

From the 97 Australian participants are 54 % males and 46 % females. From the 118 German participants are 53 % males and 47 % females. In total, of the 215 considered participants are 53 % males and 47 % are females. This shows that there is on a percentage basis a balance between males and females within the countries, but also across the countries.

The 97 Australian and the 118 German participants relate to different age groups. 18 % of the Australian participants are between 18 and 30 years, 47 % are between 31 and 50 years, 27 % are between 50 and 67 years and 8 % are 67 years and older. In contrast, 36 % of the German participants are between 18 and 30 years, 26 % are between 31 and 50 years, 30 % are between 50 and 67 years and 8 % are 67 years and older. In total, 28 % of the participants are between 18 and 30 years, 36 % are between 31 and 50 years, 28 % are between 50 and 67 years and 8 % are 67 years and older. As can be seen, in each country only 8 % of the participants are 67 years and older.

After the necessary adjustments for Australia, all 97 Australian participants have public health insurance. In addition, 70 % of the Australian participants with public health insurance have

also supplementary private health insurance. For the 118 German participants the results look different, because here the private health insurance can also have a substitutive function to public health insurance. 88 % of the German participants are enrolled in a public health insurance program, while 12 % use private health insurance as a substitute function. In addition, only 7 % of the German participants use supplementary private health insurance, which represents at the same time 8 % of these participants, who have also public health insurance. It should be noted that the participants, who have substitutive private health insurance, are currently not able to use the eHC, because private health insurance companies have suspended their participation in the eHC implementation. However, because this issue can change quickly, the answers of these participants are also considered. This decision is also made due to the fact that private health insurance companies were at the beginning on board and therefore the eHC is not completely unknown for them and therefore perhaps also not for their customers.

The first specific question of the questionnaire asks, if the participants are informed about the e-health solution of their country. While only 14 % of the 97 Australian participants are informed, 32 % of the 118 German participants answer that they are informed. In total, this represents 24 % of the 215 considered participants or in other words 52 of the 215 considered participants. In addition, while only 18 % of all included males are informed, 31 % of all involved females are informed. Further, 25 % of the participants between 18 and 30 years are informed, while 22 % of the participants between 31 and 50 years are informed. Moreover, 30 % of the participants, who are between 50 and 67 years, and 12 % of the participants, who are 67 years and older, are informed. By looking on the kind of health insurance, it can be seen that 23 % of the participants with public health insurance are informed, while 43 % of the participants, who have substitute private health insurance (in Germany only available) are informed. The rest of the participants are thus not informed. The conclusion is firstly that overall only a few participants are informed about the e-health solution of their country. However, the German participants are more informed on a percentage basis than Australian participants. Secondly, even if fewer females than males participate, on the other hand more females than males are informed. Thirdly, according to the age group, it should be noted that the group of the 67 years and older are by far less informed than the participants belonging to the other age groups (absolute and on a percentage base); however, they are also less represented. A statement about the numbers related to the different kind of health insurance programs needs to be handled with care, as substitutive private health insurance is only available in Germany. Therefore, the type of health insurance is not further considered.

Note: It is very important to note that based on the logical flow of the questionnaire, for the further questions only the 52 informed participants are considered, i.e. informed about the e-health solution of their country. As a consequence, 100 % belongs to 52 participants. In detail, there are 14 Australian participants and 38 German participants or in other words 21 males and 31 females. Based on the age group, this means 15 participants between 18 and 30 years, 17 participants between 31 and 50 years, 18 participants between 50 and 67 years and two participants between 67 years and older. Deviations of this statement are mentioned in the context of the specific question then.

None of the informed Australian participants think that the federal government informed them enough about their e-health solution. Instead, 79 % of these participants think that the federal government informed them not enough about their e-health solution. The rest answered that they do not know (14 %) and that they do not care (7 %). On the other hand, at least 8 % of the informed German participants think that the federal government informed them enough about their e-health solution. However, similar to the Australian participants also 79 % of the German participants think that the federal government informed them not enough about their e-health solution. The others have answered that they do not know (5 %) and that they do not care (8 %). In total, 6 % agree, 79 % disagree, 8 % do not know and 8 % do not care. What can be seen is that in both countries the majority of the informed participants (79 %) believe that their federal government has not informed them enough about their e-health solution. However, because these participants are informed about the e-health solution of their country, it must be concluded that they got the information from other sources.

From the 14 informed Australian participants are 50 % working in the healthcare sector. Compared to that, from the 38 informed German participants are only 32 % working in the healthcare area. The others are not working in the healthcare sector. This means in turn that the majority of the informed German participants are not employed in the healthcare sector. In total, 37 % of the informed participants are working in the healthcare sector.

Most of the informed participants, who work in the healthcare sector, are employed in a hospital (42 %). Some informed participants are employed in a health insurance company (21 %) or in a pharmacy (21 %). The rest are working in another affiliation (11 %) or in a medical practice for dentists (5 %). Thereby, 63 % of these informed participants specify as area of work/position that they are an employee. Further, 16 % mention that they are working in another area of work/position than the other listed answers, while 11 % are employed as an administrator. In addition, 5 % are employed as a dentist and another 5 % as a pharmacist.

Related to the question, if participants like the e-health solution of their country, informed Australian participants give following answers: 21 % say yes, 21 % say no, 50 % answer that they do not know and 7 % mention that they do not care. In contrast, from the informed German participants say 29 % yes, state 24 % no, answer 39 % that they do not know and mention 8 % that they do not care. In total, this means that 27 % say yes, 23 % state no, 42 % answer that they do not know and 8 % mention that they do not care. Based on these findings it can be stated that 42% of the participants, who are informed about the e-health solution of their country, do not have a clear opinion, if they like their e-health solution or not. Only 27% like the e-health solution of their country and there is, in percentage terms, a little bit better mindset of the e-health solution in Germany than in Australia.

Further, while 79 % of the informed Australian participants would like to have influence on the development of their e-health solution, only 61 % of the informed German participants think in this way. From the remaining informed Australian participants, 14 % do not know and 7 % do not care. The rest of the informed German participants answer following: 13 % would not like to have influence on the development of their e-health solution, 16 % do not know and 11 % do not care. In total, this means that 65 % of the informed participants would like to have influence on the development of their e-health solution, while 10 % disagree, 15 % do not know and 10 % do not care. Especially in Australia such a request exists.

The next questions asks, if participants are generally concerned about data protection/data security/privacy regarding their e-health solution. From the informed Australian participants are 71 % generally concerned, 14 % are not generally concerned and 14 % do not know. On the other hand, 63 % of the informed German participants are generally concerned, while 26 % are not generally concerned, 8 % do not know and 3 % do not care. Based on all given answers, this means that 65 % are generally concerned about data protection/data security/privacy regarding their e-health solution, while 23 % are not generally concerned, 10 % do not know and 2 % do not care. Overall, it can be seen that data protection/data security/privacy play an important role in people's mind and therefore are definitely a critical success factor. Further, it should be noticed that, in percentage terms, small differences between Australia and Germany exit for these issues.

In the next step, participants had to evaluate possible situations/circumstances/feelings based on their level of concern regarding data protection/data security/privacy. However, this question is related to the former question, which means that only the informed participants, who are generally concerned about data protection/data security/privacy regarding their e-

health solution, had to evaluate their level of concern. This means that from the 52 informed participants only 34 participants (65 %) had to answer this specific question. The results are illustrated in the following figure 25. As this figure clearly demonstrates, the misuse of health data represents the highest concern. Alone 56 % of the participants evaluate this issue with very high concern. Even if very high concern and high concern are aggregated, the misuse of health data still represents with 80 % the highest concern. The second highest amount of very high concern relates to the transparent patient (38 %) followed by a hacker attach including a personal health data theft (35 %). Transparent patient means for example that through the electronic storage of patient's health data, authorized (of course also unauthorized) users can get detailed and intimate knowledge of a patient, which is not stringently required for them to know. The fewest concerns apply for the continuous uneasy/bad feeling during the daily life. In summary, what can be clearly identified is the fact that data protection/data security/privacy are essential issues. Countries have to consider them while working on their national e-health solutions. In particular, adequate measures are needed to avoid health data misuse and successful hacker attacks.
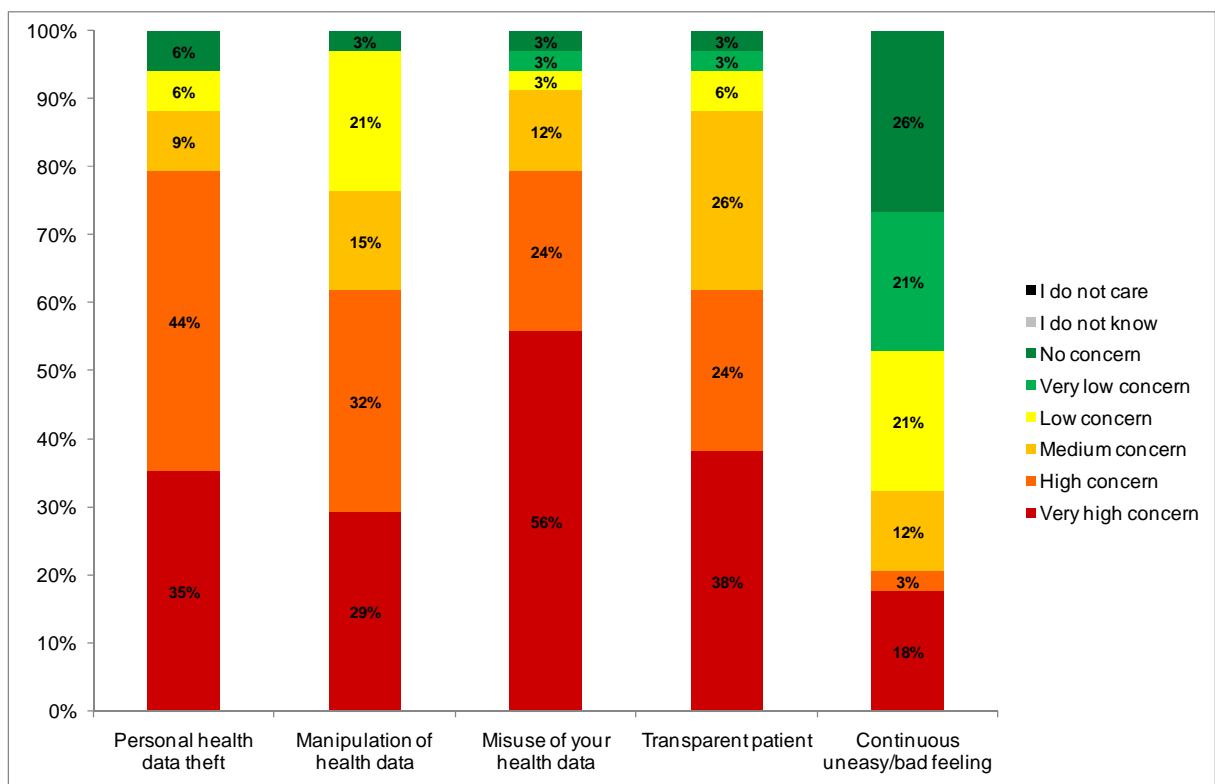
Figure 25: Level of concern regarding data protection/data security/privacy
[Some descriptions of the situations/circumstances/feelings, which a participant had to evaluate, are shortened in this figure. However, the full descriptions as given in the questionnaire (appendix 2) are presented in the following, starting from the left of the figure to the right: 1. Personal health data theft: hacker attack; 2. Manipulation of health data: hacker attack; 3. Misuse of your health data; 4. Transparent patient; 5. Continuous uneasy/bad feeling during your daily life.]

The following figure 26 presents which e-health functions the 52 informed participants would like to use, if they could decide. The listed answers are the planned e-health functions of Australia and some of previous and current planned e-health functions of Germany. Before the figure and the facts are presented, it should be noted that the percentages are calculated in this figure differently. Because this question allows a participant to give several answers, the percentages refer here to the ratio between given votes for the specific e-health solution and total votes for the whole question. The 14 informed Australian participants have given in total 130 votes, whereas the 38 informed German participants have given 309 votes. Overall, this means 439 votes.
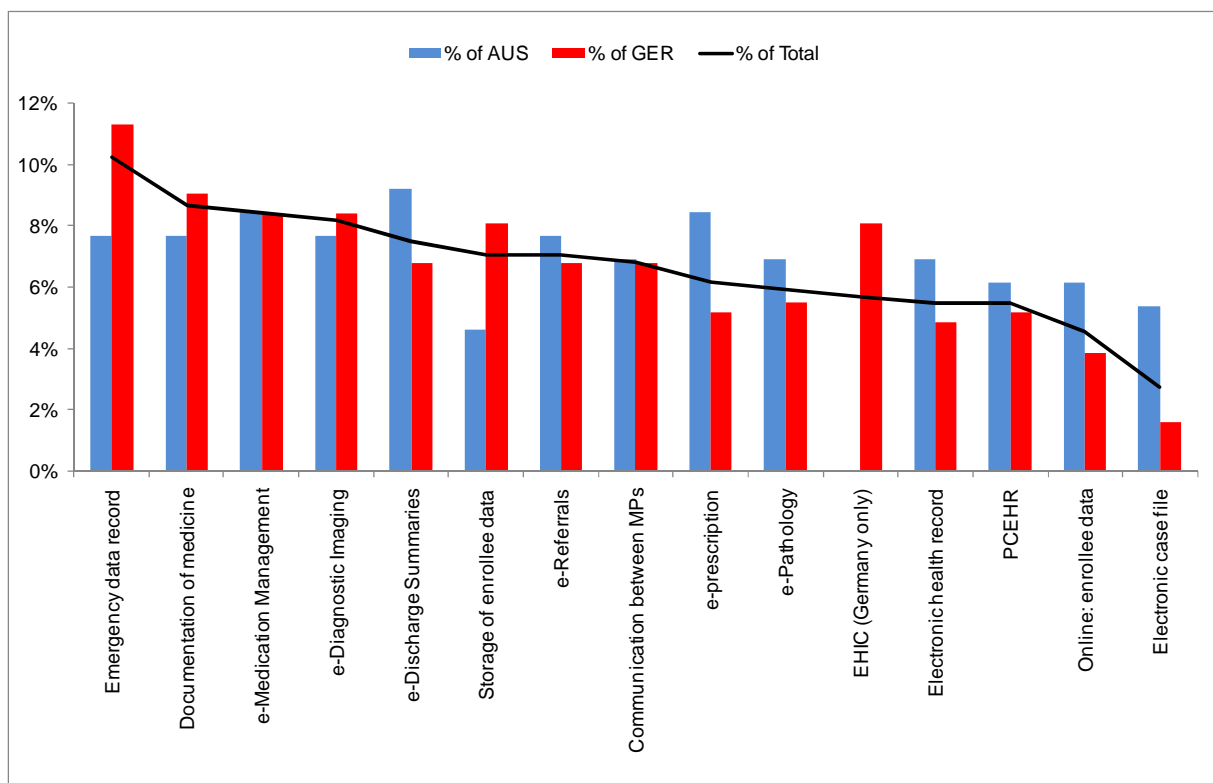
Figure 26: Preferred e-health functions that participants would like to use
[The European Health Insurance Card (EHIC) was only listed as response option for the German participants. In addition, some descriptions of the e-health functions are shortened in this figure. However, the full descriptions as mentioned in the questionnaire (appendix 2) are presented in the following, starting from the left of the figure to the right: 1. Emergency data record; 2. Documentation of medicine; 3. e-Medication Management: improved use of medicines and a reduction of the number of adverse medication events; 4. e-Diagnostic Imaging: aims to enable a nationally-endorsed, consistent and secure electronic exchange of diagnostic images across the healthcare sector; 5. e-Discharge Summaries: enable the electronic exchange of comprehensive and accurate patient reports between hospitals and primary healthcare sectors; 6. Storage of enrollee data; 7. e-Referrals: facilitate the seamless exchange of significant patient information from one treating healthcare provider to another; 8. Communication between medical practitioners; 9. e-prescription; 10. e-Pathology: aims to enable a nationally-endorsed, consistent and secure exchange of pathology information across the healthcare sector, using an agreed approach and standardized format; 11. European Health Insurance Card; 12. Electronic health record; 13. Personally controlled electronic health record; 14. Online: possibility to check and update enrollee data; 15. Electronic case file. It should be noted that NEHTA's explanations of the different e-communications were copied and used in the questionnaire (NEHTA 2013f; NEHTA 2013g; NEHTA 2013h; NEHTA 2013i; NEHTA 2013j).]

Figure 26 illustrates that 9 % of the votes from the informed Australian participants refer to the e-Discharge Summaries, while only 5 % of the votes are given to the storage of enrollee data. In comparison, the informed German participants have other preferences. 11 % of their votes apply for the emergency data record, while the electronic case file gets with 2 % the fewest votes. It total, it can be seen that the emergency data record gets the most votes (10 %) and on the other hand the electronic case file receives the fewest votes (3 %). The biggest deviations between the votes of the informed Australian participants and the informed German participants relate to the emergency data record (4 % deviation), electronic case file (4 % deviation), storage of enrollee data (3 % deviation) and e-prescription (3 % deviation). It should be noted that the EHIC was not listed as response option for the Australian participants; therefore, there is no comparison possible. Overall, it can be seen that informed participants of both countries are open for e-health functions of other countries. Further, the electronic case file do badly among informed German participants, which can be a problem as this e-health function is coming with the online rollout step 2 in Germany.

The next question of the questionnaire asks the 52 informed participants, if they would like the idea to have access to their health information, when they are abroad. All 14 informed Australian participants (100 %) like this idea. From the 38 informed German participants like 76 % the idea, while 8 % do not like the idea, 13 % do not know and 3 % do not care. In total, this means that 83 % like this idea, 6 % do not like the idea, 10 % do not know and finally 2 % do not care. In summary, it can be noted that the informed participants highly support the idea to have access to the health information, when they are abroad.

With the next question, the link to research question is made. This question asks the 52 informed participants, if they think that the transferability of e-health solutions across countries is possible. 57 % of the informed Australian participants vote that the transferability of e-health solutions across countries is possible. However, 21 % of the informed Australian participants do not think that this is possible and another 21 % do not know. In contrast, 42 % of the informed German participants think that the transferability of e-health solutions across countries is possible. Nevertheless, 21 % do not think so, 29 % do not know and another 8 % do not care. In total, 46 % of the informed participants think that the transferability of e-health solutions across countries is possible, this means almost 50 %. 21 % of the informed participants do not think that transferability of e-health solutions across countries is possible. 27 % of these informed participants do not know, while 6 % do not care. By considering the gender, it can be stated that 48 % of the 21 informed males and 45 % of the 31 informed females think that the transferability of e-health solutions across countries is possible.

Moreover, 47 % of the informed participants between 18 and 30 years think that the transferability of e-health solutions across countries is possible, while 53 % of those between 31 and 50 years have the same mindset. Further, 39 % of the informed participants between 50 and 67 years and 50 % of the informed participants aged 67 years and older think that the transferability of e-health solutions across countries is possible. Thus, the conclusion is firstly that 46% of the 52 informed participants think that the transferability of e-health solutions across countries is possible. Secondly, the informed Australian participants think with a higher value (15 % points) than the informed German participants that the transferability of e-health solutions across countries is possible. Thirdly, the gender and age group has on a percentage basis no noticeable influence, if the informed participants agree that the transferability of e-health solutions across countries is possible.

Note: It is very important to note that based on the logical flow of the questionnaire, for the further questions only the informed participants are considered, i.e. informed about the e-health solution of their country, who also think that the transferability of e-health solutions across countries is possible. As a consequence, 100 % belongs to 24 participants. In detail, there are eight Australian participants and 16 German participants or in other words ten males and 14 females. Based on the age group, there are seven participants between 18 and 30 years, nine participants between 31 and 50 years, seven participants between 50 and 67 years and one participant between 67 years and older. Deviations of this statement are mentioned in the context of the specific question then.

Figure 27 shows several factors/barriers and how informed participants, who also think that the transferability of e-health solutions across countries is possible, evaluate the influence of these factors/barriers on the transferability of e-health solutions. 54 % of the 24 participants believe that planning mistakes have a very high influence on the transferability of e-health solutions. Further, participants assign also the federal government/laws (46 %) and the costs (42 %) a very high influence regarding the transferability of e-health solutions. If very high influence and high influence are aggregated, the results change, because healthcare systems of the countries (same/similar/different) achieve with 92 % the highest value. In second place comes the federal government/laws (83 %) and on third place the costs (79 %). As can be seen, the shift from only very high influence to the aggregation of very high influence and high influence leads to a replacement on the first place, namely planning mistakes through healthcare systems of the countries (same/similar/different). The second place and third place are not affected through this aggregation. On the other hand, the participants allocate the existing telematics infrastructure the fewest influence on the transferability of e-health

solutions (13 % very high influence; 38 % aggregated of very high and high influence). The others issues namely culture (38 % very high influence; 54 % aggregate of very high and high influence), time (29 % very high influence; 63 % aggregate of very high and high influence) and e-health institutions/organizations (29 % very high influence; 50 % aggregate of very high and high influence) reveal no extreme values and can be therefore classified as the middle. Based on these results it can be concluded that all factors/barriers play a role for the transferability of e-health solutions across countries. However, planning mistakes, costs, time and healthcare systems of the countries (same/similar/different) are the issues, which need to be focused specifically.
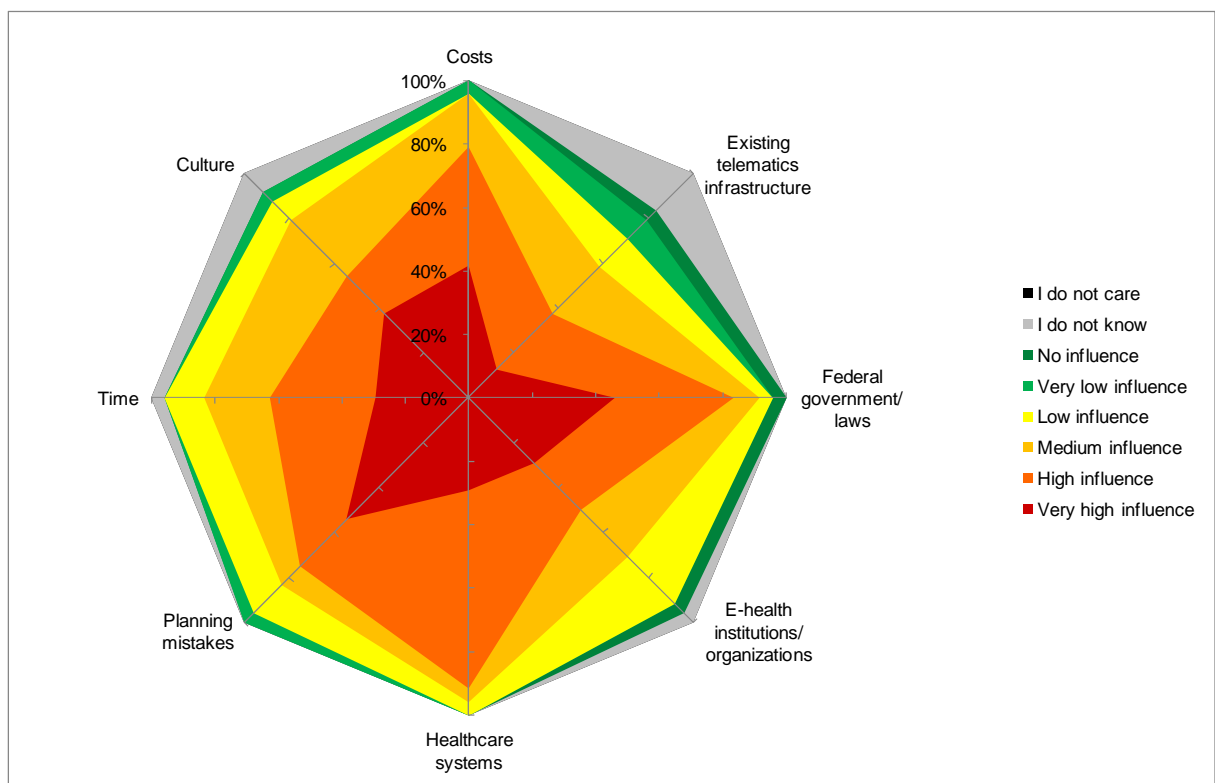
Figure 27: Influence of several factors/barriers on the transferability of e-health solutions
[Some descriptions of the factors/barriers are shortened in this figure. However, the full descriptions as mentioned in the questionnaire (appendix 2) are presented in the following: 1. Costs; 2. Existing telematics infrastructure (IT infrastructure); 3. Federal government/laws; 4. E-health institutions/organizations; 5. Healthcare systems of the countries (same/similar/different); 6. Planning mistakes; 7. Time; 8. Culture.]

One step further, the 24 participants, who are informed about their e-health solution and also think that the transferability of e-health solutions across countries is possible, are asked, if they see any strengths/opportunities after an e-health solution has been transferred from one country to another country. 88% of these participants see such strength/opportunities, which are 21 of 24 participants. Interesting is that this perception is exactly the same among Australian and German participants (88% each). Another remarkable fact is that none of the participants answered with no. In addition, 13 % of the Australian participants answered that

they do not know. Further, 6 % of the German participants respond that they do not know and another 6 % say that they do not care. In total, this means that 8 % do not know and 4 % do not care. In conclusion, a large amount of participants see strength/opportunities after an e-health solution has been transferred from one country to another country.

On the other hand, the 24 participants, who are informed about their e-health solution and also think that the transferability of e-health solutions across countries is possible, are as well asked, if they see any weaknesses/threats after an e-health solution has been transferred from one country to another country. While 88 % of the Australian participants see such weaknesses/threats (same percentage as for the strengths/opportunities), 81 % of the German participants have the same mindset. The remaining Australian participants (13 %) answered that they do not see weaknesses/threats. The remaining German participants have assigned their votes to "No", "I do not know" and "I do not care" with the same ratio of 6 % each. In total, 83% or in or words 20 of these 24 participants see weaknesses/threats, while 8 % do not see them, 4 % do not know and another 4 % do not care. In summary, similar to the strengths/opportunities, a large amount of participants see weaknesses/threats after an e-health solution has been transferred from one country to another country. The interesting fact is that the perception, in percentage terms, among Australian participants is stronger than among German participants, which is already known from earlier results, where participants have to mention, if they are generally concerned about data protection/data security/privacy regarding their e-health solution.

The 21 participants, who see strength/opportunities after an e-health solution has been transferred from one country to another country, are further asked to choose from a list of potential answers the strength/opportunities, which they see in this context. The 20 participants, who see weaknesses/threats after an e-health solution has been transferred from one country to another country, are asked to choose from a list of potential answers the weaknesses/threats, which they see in this context. The results are presented in the following figure 28 and figure 29. In this way, the strength/opportunities are confronted with the weaknesses/threats. While figure 28 presents the findings for all participants, figure 29 separate the findings for Australian participants and German participants. Because both questions allow a participant to give several answers, the percentages refer here to the ratio between given votes for the specific strength/opportunity respectively the specific weakness/threat and total votes for the whole question. The strengths/opportunities question achieves overall 72 votes, while 27 votes come from the seven Australian participants and 45 votes are from the 14 German participants. In contrast, the weaknesses/threats question

achieves overall 35 votes, while 14 votes are from the seven Australian participants and 21 votes are from the 13 German participants. It is very important to note that the comparison in both figures requests to hide the potential weakness/threat "Transferred e-health solution is not the best practice", because there is no equivalent on the strengths/opportunities side. This potential weakness/threat gets two votes from the German participants, which represents 10 % of the German participants' votes. In total, these two votes are 6 % of the 35 votes. However, the percentages for weaknesses/treats are calculated with the total votes of 35 in order to ensure the correct proportions.
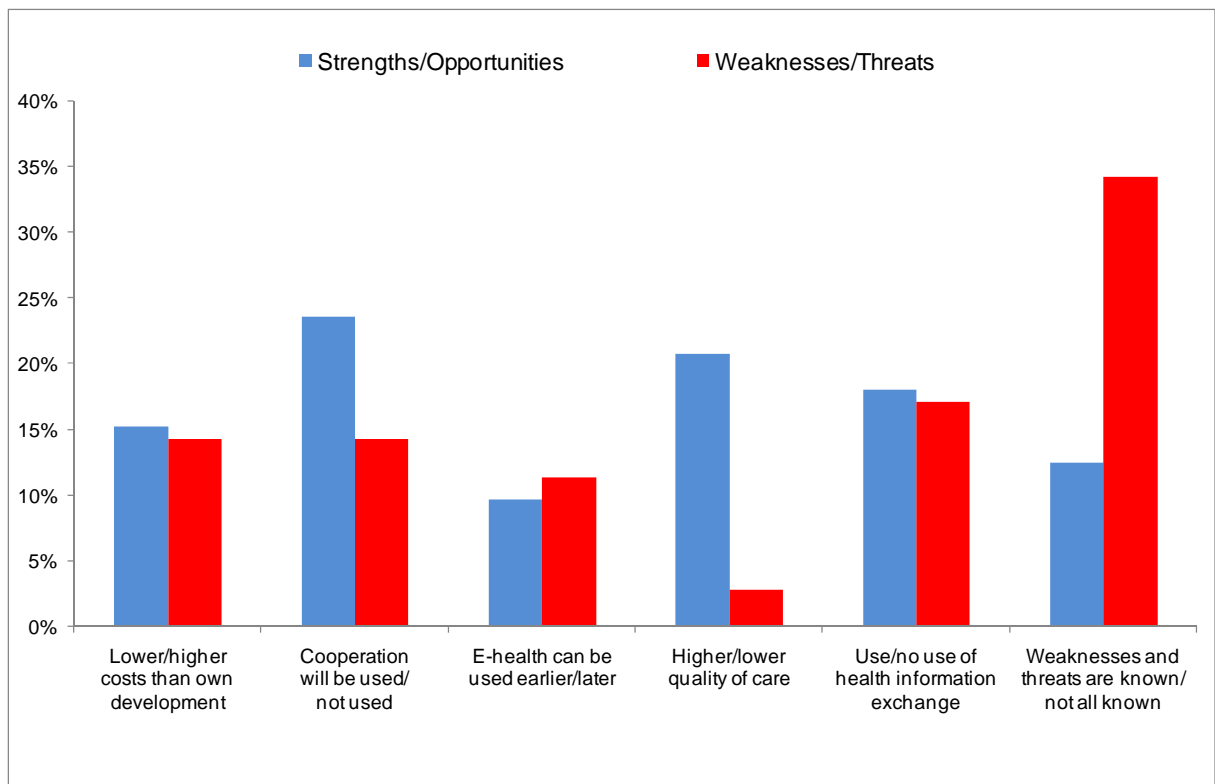
Figure 28: The strengths/opportunities and weaknesses/threats after an e-health solution has been transferred from one country to another country
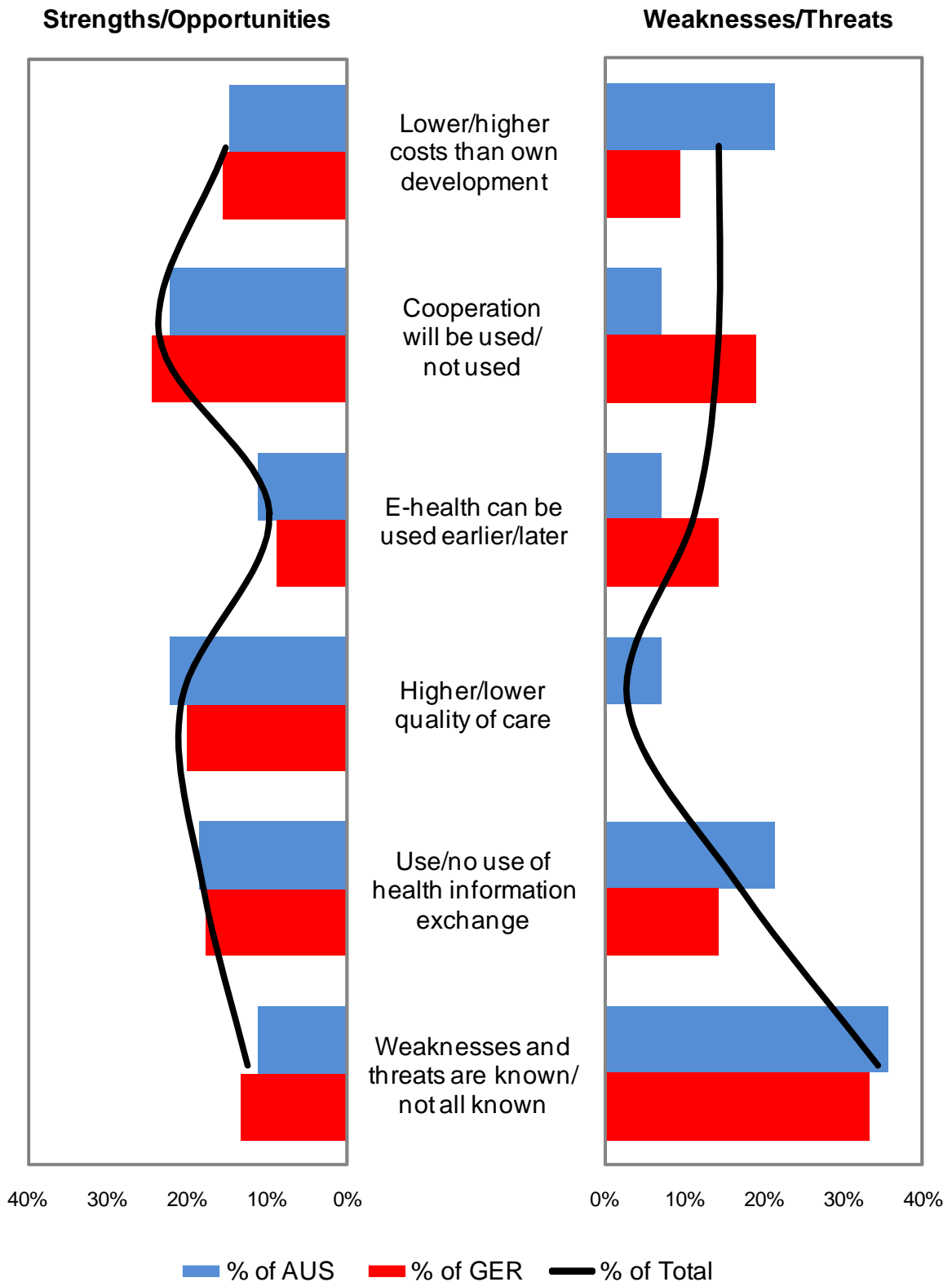[It should be noted that one potential weakness/threat, namely "Transferred e-health solution is not the best practice", is hidden; however, the two votes are included in the total votes and therefore in the calculation of all percentages. The descriptions of the strengths/opportunities and weaknesses/treats are shortened in this figure. However, the full descriptions as mentioned in the questionnaire (appendix 2) are presented in the following, starting from the left of the figure to the right. 1. Lower costs than an own development vs. Higher costs than an own development; 2. Cooperation for further e-health solution development between these countries is possible vs. Cooperation for further e-health solution development will not be used in the future and therefore e-health solutions will change differently; 3. E-health can be used earlier compared with the development of an own e-health solution vs. E-health can be used later compared with the development of an own e-health solution; 4. Higher quality of care vs. Lower quality of care; 5. Health information exchange between these countries is possible vs. Health information exchange between these countries will not be used; 6. Several weaknesses/threats regarding data protection/data security/privacy are already known vs. Inattention, because people think that all weaknesses/threats regarding data protection/data security/privacy are already known.]

Figure 28 illustrates how participants evaluate the strengths/opportunities and the weaknesses/threats, providing that an e-health solution has been transferred from one country

to another country. On the side of the strengths/opportunities are most of the participants' votes (24 %) given to the issue that cooperation for further e-health solution development between these countries is possible. The second highest amount of votes (21 %) assign for higher quality of care. The fewest votes (10 %) are given to the matter that e-health can be used earlier compared with the development of an own e-health solution. On the side of the weaknesses/threats, the participants' votes allocate largely to the issue "Inattention, because people think that all weaknesses/threats regarding data protection/data security/privacy are already known". On the second place follows with 17 % the weakness/threat that health information exchange between these countries will not be used. The fewest votes (3 %) are given to lower quality of care.

In comparison to figure 28 shows figure 29 a more detailed overview of the strengths/opportunities and weaknesses/threats by splitting the findings among Australian participants and German participants. For the strengths/opportunities exist, in percentage terms, almost no differences among the votes of the Australian participants and the German participants. However, for the weaknesses/threats exist, in percentage terms, for almost all items clear differences among the votes of Australian participants and German participants. The only exception is "Inattention, because people think that all weaknesses/threats regarding data protection/data security/privacy are already known", as here almost no variation among the votes of Australian and German participants can be identified on a percentage basis.

In a further question, the 20 participants, who see weaknesses/threats after an e-health solution has been transferred from one country to another country, are further asked to evaluate the overall level of risk regarding the transferability of e-health solutions across countries. 14 % of the Australian participants evaluate the overall level of risk with very high, 43 % with high and another 43 % with medium. In comparison, 8 % of the German participants evaluate the overall level of risk with very high, while 23 % vote for high and 69 % for medium. Overall, this means that 10 % of these 20 participants see a very high risk, 30 % a high risk and 60 % a medium risk. Based on these findings, it can be concluded that most of the participants see the risk regarding the transferability of e-health solutions across countries between medium and very high, whereby medium risk (60%) achieve by far the highest result. Further, the Australian participants see a higher risk, in percentage terms, than the German participants. This is similar to earlier findings, where participants have to mention, if they are generally concerned about data protection/data security/privacy regarding their e-health solution and also where they have to state, if they see any weaknesses/threats after an e-health solution has been transferred from one country to another country.

Figure 29: The strengths/opportunities and weaknesses/threats after an e-health solution has been transferred from one country to another country, split by country

[It should be noted that one potential weakness/threat, namely "Transferred e-health solution is not the best practice", is hidden; however, the two votes are included in the total votes and therefore in the calculation of all percentages. It is important to note that the descriptions of the strengths/opportunities and weaknesses/treats are shortened in this figure. However, the full descriptions are the same as for the former figure 28. In addition, the full descriptions can be seen in the questionnaire (appendix 2).]

The last question of the questionnaire asks participants, if they could imagine that we will see a global e-health solution in the future. Because this question is in the questionnaire not related to the transferability aspect, the 52 informed participants have answered this question. 71 % of the informed Australian participants can imagine a global e-health solution, while 21 % cannot imagine that and 7 % do not know. For 34 % of the informed German participants, a global e-health solution is imaginable, while 47 % cannot imagine a global e-health solution. Another 16 % do not know and 3 % do not care. By considering all informed participants, the results are that 44 % of the informed participants can imagine a global e-health solution, 40 % cannot imagine a global e-health solution, 13 % do not know and 2 % do not care. Based on the gender, 43 % of the males and 45 % of the females could imagine that we will see a global e-health solution in the future. Further, 47 % of the informed participants between 18 and 30 years, 53 % of the informed participants between 31 and 50 years, 39 % of the informed participants between 50 and 67 years and none of the informed participants, who are 67 years and older, think that a global e-health solution is possible in the future.

Overall, there is no clear tendency visible that a global e-health solution is seen to be possible in the future. Nevertheless, for the informed Australian participants, a global e-health solution is on a percentage basis two times more possible than for informed German participants. This means that 71% of the informed Australian participants think that a global e-health solution is possible in the future, whereas only 34% of the informed German participants think that this is possible. This is an interesting point to note, because the informed Australian participants have also shown, in percentage terms, a more positive mindset regarding the transferability of e-health solutions across countries than the informed German participants. Further, it can be seen that the gender has on a percentage basis almost no influence, if the informed participants agree that a global e-health solution is possible in the future. In addition, it is shown that the age plays, in percentage terms, a role in the positive perception of a global e-health solution. For the younger generation (i.e. between 18 and 50), there is a clear tendency for a global solution with around 50% positive votes compared to the older generation (i.e. 50 and older) with only around 35% positive votes. One reason is that 100% of the informed participants, who are 67 years and older, do not think that a global e-health solution is possible in the future.

Finally, it is important now to examine, if there is a link between informed participants, who think that the transferability of e-health solutions across countries is possible and those, who could imagine that we will see a global e-health solution in the future. As known, 44 % of the

informed participants think that a global e-health solution is possible. The interesting fact is that this result increases to 63 %, by selecting only the informed participants, who also believe that the transferability of e-health solutions across countries is possible. In other words this means that informed participants, who think that the transferability of e-health solutions across countries is possible, also have a very high tendency to believe on a global e-health solution in the future. On the other hand, informed participants, who think that the transferability of e-health solutions across countries is not possible, also have a very low tendency to believe on a global e-health solution in the future (only 18 % vs. 44 %).

In summary, this section has shown the findings of the questionnaires from Australia and Germany. Firstly, it is shown, that overall only a few participants are informed about the e-health solution of their country (24 %). However, the German participants are more informed on a percentage basis than Australian participants (32 % vs. 14 %). Secondly, it is stated that 46 % of the 52 informed participants think that the transferability of e-health solutions across countries is possible. Though, the informed Australian participants think with a higher value (15 % points) than the informed German participants that the transferability of e-health solutions across countries is possible. Thirdly, there is overall no clear tendency visible that a global e-health solution is seen to be possible in the future. Nonetheless, for the informed Australian participants (71 %), a global e-health solution is two times more possible than for the informed German participants (34 %). This is an important fact, as the informed Australian participants have also shown, in percentage terms, a more positive mindset regarding the transferability of e-health solutions across countries than the informed German participants. Finally, it is presented that informed participants, who think that the transferability of e-health solutions across countries is possible, also have a very high tendency to believe on a global e-health solution in the future and the other way around.

At the end, it should be noted that the findings of the questionnaire refer to different views of the conceptual framework (see section 4.1, figure 24, no. 1-4). The findings regarding the Australian national e-health solution relate to no. 1, while the findings regarding the German national e-health solution refer to no. 2. As can be seen, these findings relate to the micro, mezzo and macro view of the study and in detail to the specific country. The results regarding the transferability of e-health solutions refer to no. 3 and therefore to the macro view. However, to be precise, the findings regarding the SWOT in particular relate to the two involved countries, i.e. macro, mezzo and micro view, as the findings already assume a conducted successful transfer. The findings regarding the global e-health solution relate to no. 4 and consequently to network centric healthcare operations (NCHO).

4.4 Ethnographic Study

In Australia and Germany, the researcher has performed fieldwork to study the people within their environment. This is important to fully understand the context including the culture, behaviors and attitudes of healthcare actors. Where necessary, the researcher has asked people about observed events in order to get more detailed insights and/or validate the observations. Further, secondary data in form of internal hospital documents were used.

In both countries, the ethnographic study was conducted at a hospital. In Australia, the chosen hospital was a private hospital. In Germany, the selected hospital was a public hospital, where the mission statement is oriented on the Christian anthropology.

There are several reasons, why in each country a hospital was chosen for conducting the ethnographic study. Firstly, hospitals have a variety of patients, which increases the chance for diversified observations, while processes can be analyzed in a more detailed manner due to a higher flow rate. Secondly, hospitals involve several e-health stakeholders including medical practitioners, nurses and IT-experts. Finally, because hospitals have a big range of employees, the possibility for conversations is much higher. In this way, the intension of the researcher was also to establish new contacts with different e-health stakeholders, which can be used at a later stage to conduct interviews by using the interview protocol (see appendix 1). However, it is important to note that the results of these interviews are presented separately in section 4.2, as they are outside the context of the ethnographic study in Australia and the ethnographic study in Germany.

It should be noted that the ethnographic study in Australia and the ethnographic study in Germany are not full ethnographic studies as such; rather they are components of the complete study. In the context of the whole research, they only serve to understand the micro view of the study, namely the national e-health stakeholders of each country. According to the revised conceptual framework (see section 4.1, figure 24, no. 1-2, micro view), the findings of the ethnographic study in Australia refer to no. 1 (micro view), while the findings of the ethnographic study in Germany relate to no. 2 (micro view).

In the following subsections, the findings from the Australian hospital and the German hospital are presented. The findings are grouped and appropriate headings are determined. The headings are underlined and the findings are highlighted in bold. Finally, the implications including the similarities and differences between the Australian hospital and German hospital are stated.

4.4.1 Australia

In Australia, the ethnographic study was accomplished at a private hospital. In this way, the ethnographic study was conducted in three diverse steps in different phases of the dissertation. Firstly, the researcher has done an extensive site visit at the hospital. Secondly, the researcher participated for several weeks in the hospital's e-health project team, which was responsible for the development of an e-health strategy. Thirdly, the researcher observed for one day the knee and hip surgeries and spoke in the course of this with the medical staff. The details of each step are presented and discussed in the next three subsections.

4.4.1.1 Extensive Site Visit

The researcher had the opportunity for a one day extensive site visit at the private hospital, which helped to gain first insights about the hospital and its different departments. In this way, the researcher had also the opportunity to speak to different employees including doctors and nurses and to ask questions, which arose during the extensive site visit. This was very important as these insights were received at a time, where the researcher also worked on his research proposal and in this way on his research question. In addition, this extensive site visit at the Australian private hospital served as a "pilot".

The extensive site visit has shown several strengths and opportunities, because the hospital is **well equipped** with new technology and medical equipment. For example, the machines for CTs, MRIs, and X-rays are highly up to date. Moreover, it is shown that the hospital employs a multiplicity of **well experienced people**, who have the routine in the exercise of their job. This is the base for a **high patient demand** in the future.

Further, during the extensive site visit, the researcher has identified several weaknesses and threats, because **department thinking**, **platform centric approaches** and **media disruptions** are quite common in this hospital. For example, different departments use different types of software, e.g. software to monitor the pulse and heart rate of patients or software to create and store X-rays. In addition, the X-rays are forwarded to specific departments via floppy disks. This procedure is on the one hand **inefficient** and **time consuming**, but on the other hand also **dangerous**, as in case of emergency, other departments may also need access to the X-rays of patients immediately. Also other healthcare stakeholders may require access to them.

Therefore, even if departments and healthcare stakeholders have different goals, there is at least the need for an appropriate facilitator, namely an **overall e-health solution**, which has a

network centric perspective. This allows to exchange and access patient's health data within the hospital, but also where necessary within Australia and a step further overseas.

In summary, based on this extensive site visit, the researcher has identified several strengths and opportunities as well as weaknesses and threats. Based on them, the hospital needs a clear e-health strategy including an appropriate e-health solution, which has a network centric perspective. In detail, this means that the hospital requires a suitable e-health solution, which allows an unrestricted, multidirectional flow and exchange of health information among the different hospital departments, but also among the different healthcare players in Australia and further globally.

4.4.1.2 E-Health Strategy

Another part of the ethnographic study at the Australian private hospital was that the researcher participated in the hospital's e-health project team, which is responsible for the development of an innovative e-health strategy. In detail, the goal is to define an overall e-health solution for the hospital, which is able to address the current challenges and needs.

This section gives an overview of the background of such an e-health strategy development and mentions the phases, which need to be considered during such a project. To present this, mainly internal hospital/project documents including the hospital's strategic plan were used, which are treated anonymously. In addition, this section highlights further observations made and insights gained, while the researcher was part of the project team. However, given the situation that the researcher was not involved in the project till the end; the facts of this section represent extracts of the whole e-health strategy development and may have changed over the time of the project.

The hospital has developed a strategic plan. According to this plan, the hospital has to overcome with several <u>challenges</u> including an **aging population** requiring more health services, an existing **cost pressure**, the requirement for necessary **investments in facilities** and the <u>need</u> to **increase customer service**. Therefore, it was time for changes.

However, even if the hospital has developed a strategic vision, a strategy for the teaching hospital and a business strategy, the hospital's <u>weakness</u> and <u>threat</u> was that they **lacked in a well defined clinical strategy**, which considers clinical information systems as well as a clear innovative e-health strategy. Therefore, the specific project team was established.

In the beginning, the project team defined e-health. Further, for the development of the e-health strategy, a seven phases plan was determined. According to the first phase, it is essential to analyze the present state of the hospital. This includes an ICT situational analysis, the determination of the already available systems in the hospital and the identification and modeling of surgical and medical workflows. In the second phase, a benchmarking analysis needs to be accomplished, which includes looking at the different national e-health solutions of other countries and e-health solutions of well renowned hospitals around the globe, in order to get an overview of best practices and to gain new ideas. In the third phase, it is essential to ascertain the gap between the present state and the target state and to analyze and evaluate the identified potential e-health solutions. In the fourth phase, the e-health strategy per se has to be developed, including the definition of the e-health vision, mission, objectives and solution features for the hospital. In doing so, it is indispensable to identify and consider all internal and external influence factors (on a state, country and global level). For example, NEHTA's strategy has to be considered, as the Australian e-health solution has to fit with the hospital's e-health solution in the future. In the fifth phase, a strategy road map is required to be developed. In the sixth phase, the determination of the performance management has to be done. In the final phase, a feedback mechanism has to be defined, which represents on the one hand the last step, but which also applies on the other hand between the other steps.

While the researcher has attended the project meetings, strengths and opportunities could be observed. The **project team encompasses different e-health stakeholders** like a doctor, a former nurse and an IT expert. This is very important in order to guarantee that the different perspectives and needs of the several e-health stakeholders are considered for the e-health strategy and its definition of the e-health solution. Further, the project team involves the **high expertise of a university professor**, whose research area is specifically in e-health and who brings along experiences from other hospitals.

Nevertheless, even if different e-health stakeholders are involved in the project team, several weaknesses and threats were identified. There is still a **distance to the practice**. Departments in hospitals have diverse key activities, which mean that e.g. nurses and doctors of the different departments have varied tasks, priorities and needs. Therefore, even if single stakeholders are involved in the project team, it is hazardously to believe that this is enough to ensure that the developed e-health strategy addresses automatically the requirements of the whole hospital and its employees, patients and other stakeholders. Instead, it is more likely that the defined **e-health strategy do not meet the healthcare stakeholder's requirements**. This is **critical for the success** and the **acceptance** of the resulting e-health solution. Based

on these risks, there were two potential <u>facilitators</u> identified. Firstly, the **project meetings need to be conducted decentralized** by rotating between the different departments. In this way, the ideas and the progresses can be shared with employees within their environment and necessary adaptations can be made directly. Further, the final e-health strategy including the e-health solution definition needs a **validation throughout the hospital and its stakeholders**. Though, such considerations were neglected, while the researcher participated in the project.

Furthermore, based on the proceeding to develop an e-health strategy, there is still the overall <u>weakness</u> and <u>threat</u> of **platform centric thinking**, as the hospital focuses on its own e-health solution. Even if NEHTA's strategy and Australia's national e-health solution are considered and integrated into the definition of the hospital's e-health solution, there is still the need for a <u>facilitator</u>, namely **network centric healthcare on a global scale**; otherwise a global health information access is still unachievable. This also confirms that already the macro level, i.e. the national e-health solution, needs an appropriate e-health design.

This section has shown that the hospital focuses on an innovative e-health strategy. The background and the phases for this strategy development were presented. Further observations and insights were mentioned as well. In conclusion, firstly the stakeholders are not involved enough in the development of the e-health strategy and in this way in the definition of the hospital's e-health solution. Secondly, the e-health strategy and its resulting e-health solution seem to be not in line with network centric healthcare so far, at least not on a global scale.

4.4.1.3 Observation of Surgeries

At the private Australian hospital, the researcher had the chance to observe for one day the knee and hip surgeries and to speak in the course of this with the medical staff to get more detailed insights and/or validate the observations. This possibility was very important in order to identify important factors of a surgery, which are relevant for the context of this research, and to gain the corresponding key insights. In addition, these findings give the option to contrast and understand general differences among the Australian and German hospitals (see section 4.4.3). The identified <u>important factors</u> and corresponding <u>key insights</u> are:

- **Preparation of a patient:** there is **no extra room**, where the anesthetist gives the patient the anesthesia, because this process is done directly in the operating room. This is **inefficient**, as the next patient cannot be prepared adequately for the surgery in advance.

- **Personnel deployment: two medical practitioners** typically perform a knee or hip surgery. The wound is kept open through the medical practitioners themselves or by using adequate tools like frames. Further, the **anesthetist** monitors the patient. In addition, **nurses** assist with the medical equipment.

- **Allergies of a patient:** they are not stored electronically. They are only written down on a **paper-based** record and patients with allergies have to wear a red bracelet. This is very risky, as the medical staff can make mistakes, while an electronic system can support with the help of warning signals or alarms. Additionally, if patients have to come back later in their life, the electronic system will remember the allergies. Further, other hospitals and healthcare stakeholders can benefit from this information, providing that **network centric healthcare** will be realized. This is especially useful in case of emergency, where the patient is maybe not able to speak anymore.

- **X-rays:** they are normally used in **printed form**. This is necessary as the surgeon has to use patterns in order to identify the correct size of the knee or hip prosthesis. The **electronic versions** of the X-rays are also available in case of emergency.

- **Surgery report:** after the surgery, the surgeon has to fill out a surgery report. However, these reports are usually not stored electronically. The surgeons use normally a specific **paper-based form**. Alternatively, they dictate the details and results with the help of a dictation machine, which are then transcribed by the secretary. This procedure is for the hospital maybe not a problem, because medical practitioners from the same hospital can access the paper-based record and the notes; however, the **medical staff from other hospitals or other facilities has no direct information access** and has therefore to overcome with this barrier. When the researcher has pointed out this problem, while he was speaking to a surgeon, the answer was that Australia is a little bit behind. In addition, the paper-based approach involves always the **risk that the information is unreadable**.

- **Prosthesis:** the hospital has to **fill out a paper-based form** for the Australian Orthopaedic Association (AOA), where they have to mention the used type of the prosthesis. In case of a prosthesis replacement, the reason has also to be added. For example, as a not-for-profit organization, the AOA supplies the community with orthopedic information and supports research in Australia and abroad (Australian Orthopaedic Association 2012).

- **Information exchange:** the researcher has identified a problem in the context of replacement surgeries. If there is the need for a replacement of the prosthesis (knee or hip) or at least discomfort, the medical practitioner needs to **access the former surgery report**. This can be done appropriately, if the patient had the former surgery also at this hospital, because they can inspect the available medical record of the patient. However, if the patient had the surgery at another Australian hospital or in worst case in another country (possibly **language barrier**), the medical practitioner has to **contact the other hospital and has to speak to the responsible surgeon**. In this context, a medical practitioner mentioned that a common problem is the existence of **incomplete medical records**. Therefore, there is again the request for **network centric healthcare**.

- **Material management:** the researcher could observe that the packages, which include the material for the surgeries, have a **bar code**. When the surgeon requests a specific material, the nurse or another assistant scans the bar code. This process helps the hospital with its **material administration** and its **reorders**. However, when the researcher pointed out the problem that the **hospital uses sometimes electronic support and sometimes not for the processes**, the nurse agreed.

- **E-health:** a medical practitioner has expressed the **concern** that they may have the **most work with e-health** in the future.

- **Special equipment:** the researcher had the opportunity to observe a surgery, where the surgeons have used a specific machine, which includes sensor technique. The **results of the sensors are printed** out and archived in the patient's paper-based record. However, the **results are not stored in electronic form**. Moreover, there is **no connection between this machine and the other applied machines or electronic systems**.

As this section shows, knee or hip surgeries are complex processes. Especially the documentation and the health information access is for such surgeries a very important aspect, because prostheses are involved. In this context, what clearly sticks out is the fact that the electronic documentation in this hospital is minor and that an overall e-health solution does not exist so far. The weaknesses and threats, i.e. **paper-based approaches** and **platform centric thinking** need to be overcome. The facilitator is **network centric healthcare**, i.e. the possibility of an adequate electronic health information exchange on a local, national and global scale.

4.4.2 Germany

In Germany, the researcher worked for three months in the orthopedic department of a public hospital, where the hospital's mission statement is oriented on the Christian anthropology. The domain of work was specifically the operating room, where the researcher has assisted in knee and hip surgeries. Specifically, the researcher's task was to hold up the wound with the support of hooks.

While working at the hospital, the researcher had also the chance to observe the processes of such knee and hip surgeries and to speak to staff in order to get more detailed insights and/or validate the observations. Consequently, the researcher was a participant observer.

In doing so, it was possible to identify important factors of a surgery, which are relevant for the context of this research, and to gain the corresponding key insights. Further, these findings give the option to contrast and understand general differences among the Australian and German hospitals (see section 4.4.3).

The identified <u>important factors</u> and corresponding <u>key insights</u> are:

- **Preparation of a patient:** there is an **extra preparation room** next to the operating room, where the patient gets his/her anesthesia through the anesthetist and is prepared for the surgery. In this way, the **process flow is improved**, because it is possible to prepare the next patient, while the other patient is still in the operation room or while the operating room is cleaned for the next surgery.

- **Personnel deployment: two medical practitioners** and **one hook holder (in special cases two hook holders)** perform normally a knee or hip surgery. Further, the **anesthetist** monitors the patient. In addition, **nurses** assist with the medical equipment. The employment of hook holders in such surgeries is common in this hospital and in other German hospitals, because it allows the **surgeons to concentrate more on the patient**. Further, the **surgery time can be reduced**, because while tools like frames can get out of place and therefore request repositioning, the hooks are usually kept in position with the help of the hook holder. As a consequence, also **anesthesia time can be reduced**. In addition, the usage of hooks **increases normally the visible area** for the doctors. Finally, because hook holders and the hooks can be used more flexible than the bulky tools like frames, the **cutting length of the wound is shorter** normally.

- **Allergies of a patient:** the researcher has observed a surgery, where the patient is allergic to gum. This needs to be considered during the surgery, which means e.g. to avoid the use of rubber gloves. Because the surgery was planned in advance, the medical staff had enough time to ask the patient for allergies. The hospital trusts here the statement of patient. There are no standard allergy tests in the hospital, only if the medical staff has a suspicion. The **allergy information of a patient is printed** on a list and attached to the patient's paper documents, which are deposit on the bedside. However, it is possible that a patient has to be moved to another hospital. In addition, after leaving the hospital, a new case can happen to the patient, which can mean that he/she is taken to another hospital and has to mention the allergies again. Therefore, **receptiveness**, **mental capacity** and/or **forgetfulness** can be risk factors. For that reason, the critical **paper-based approach** and moreover the problems of **platform centric thinking** have to be overcome. There is definitely the **need for an overall e-health solution, which supports NCHO**, because allergies are common and therefore such information needs to be accessible where and when required. The **emergency data record** is a possible e-health function; however, a network centric perspective needs to be considered in order to ensure unhindered access globally.

- **X-rays:** for knee or hip surgeries, the orthopedic surgery makes X-rays of the patient during the consultation. These **X-rays are stored electronically** in the hospital information system and are accessible everywhere in the hospital. As part of the preoperative planning process, the **surgeon prepares the X-rays of the patient in advance**. Thereby, the surgeon use patterns in order to identify the correct size of the knee or hip prosthesis and incorporate the suggested pattern into the electronic versions of the X-rays. Of course, these X-rays are specially prepared; however, in certain situations like follow-up examinations, a replacement surgery and/or emergency cases, the access to the X-rays could be important. A medical practitioner told the researcher, that **prepared X-rays are currently not be forwarded** to other healthcare stakeholders. The reason is simply that there is the risk of planning mistakes and the question is then, who is liable, if something happens then. However, **unprepared X-rays are forwarded** as printed versions or via CDs. As this procedure is **inefficient** and **time consuming**, again a need for **network centric healthcare** is identified. At the end, it should be noted that **complex surgeries can also request printed X-rays**, because the doctors need to be flexible during the surgery and in case of doubt are printed X-rays better to read.

- **Surgery report:** the **surgery report is stored electronically** in the hospital information system. **Also a printed version** is attached additionally to the patient's paper-based medical record. This is **platform centric thinking**, because the other healthcare stakeholders in Germany and globally are not able to access these reports, only the hospital and its departments.

- **Prosthesis:** the prosthesis has an individual ID number, which is linked with the patient in the hospital's database. With the help of this ID number and the producer it is also traceable, which hospital has done the surgery. The hospital can give then details about the surgery, the surgeon and when the surgery was done. It is expected that this ID number will be also shared with the eHC in the future.

- **Information exchange:** the researcher has observed that the health information exchange among patients and healthcare stakeholders is currently **problematic**, because the risk of information loss is quite high. In knee and hip surgeries the problem arises especially, when **replacement surgeries** are necessary and the patient had the previous surgery at another hospital. The prosthesis pass can help; however, sometimes additional information is required. If necessary, the current proceeding is that the hospital asks the patients to **get in contact with his/her previous hospital and the previous surgeon** in order to obtain the necessary information. However, patients can forget names and details of the former surgery, the previous surgeon can be retired or the former hospital's documentation (X-rays, surgery report, etc.) can be **incomplete** or **unreadable**. In addition, this procedure can take a lot of **time**. Overall, this can be a problem for the new surgery, for the purchasing of replacement parts and for the procuring of the necessary equipment. Further, this critical issue is also transferable to other surgeries and also transferable to the situation that a patient was treated in advance by his/her general practitioner, where this already existing health information can lead to better or more appropriate treatment. Therefore, there is again the request for **network centric healthcare**.

- **Material management:** the materials, which are used, have a **bar code**. While a surgery, the bar codes of the used materials are scanned and in this way referred to the surgery report of the specific patient. Further, the **stock is reduced** accordingly. In addition, as part of **quality management**, it is necessary that **every medical instrument has a number and a résumé**. Based on that it is e.g. possible to see, how often an instrument was already used and when a replacement is necessary.

- **E-health:** during a conversation with the hospital's human resource manager, several insights could be gained. Firstly, it is anticipated that the **extra effort** through the national e-health solution **is manageable**. The reason is that the documentation duty of patients' health data also exists at the moment. Further, the hospital works currently on an **electronic health record** and in this way, the processes towards the electronic documentation will be changed anyway. This means also that the hospital currently digitalizes the previous paper-based medical findings. However, even if it was not mentioned in this context, but the hospital has also to restructure the current process regarding allergies. In the future, it is expected that these electronic health data are simply shared with the eHC and its e-health functions. In addition, it is anticipated that the upload of the new health data can be done only once, namely before the patient leaves the hospital. The doctor does not necessarily have to do that, because it is conceivable that a specific team in the hospital perform this issue. Secondly, the human resource manager indicates that **health data** of a patient, which come from the eHC, **cannot be searched during the surgery by the doctor directly**, as they are sterile. In planned surgeries, this is done anyway during the preoperative planning process, while in emergency surgeries e.g. the anesthetist can search for the necessary data – assumed there is enough **time**. Thirdly, through the national e-health solution, the human resource manager sees **benefits for both**, i.e. the patient and the hospital.

- **Emergency surgery:** the researcher participated in an emergency surgery, where the patient had lost a lot of blood. In such cases, where time is very limited and decisions have to be made fast, an **emergency data record** including blood type and an overview of the patient's allergies can be very important. However, there must be enough **time** to check the health data. In the **orthopedic surgery**, the situation looks different, because **the occurrence of emergencies is minor**. A medical practitioner told the researcher that in an **orthopedic surgery**, there is in case of emergency normally enough time to have a look at the computer, which **is different compared to a vascular surgery or an accident surgery**. The orthopedic surgeon needs to know, at least approximately, what they have to expect. The medical practitioner pointed out that if there is an emergency, where there is no time for such an investigation, also the e-health card with its emergency data record will be useless, as the time for reading this health information lacks. The medical practitioner has also pointed out that an investigation within the hospital information system needs – based on his opinion – the same time compared to the e-health card solution in the future. However, this

medical practitioner has also mentioned that this possible procedure is limited to their own reports/data, which is proof for **platform centric thinking**.

This section has presented the key findings of the ethnographic study at a German hospital. As can be seen, the German hospital applies more electronic approaches than the Australian hospital, especially during the documentation. However, there is still the <u>weakness</u> and <u>threat</u> of **platform centric thinking**. Therefore, also for the German hospital the <u>facilitator</u> of **network centric healthcare** is required, i.e. the possibility of adequate health information exchange on a local, national and global scale. This means that the focus on an own electronic health record is not sufficient and that they have start to consider and integrate the national e-health solution, as this solution can help at least nationally. Furthermore, it is clearly apparent from the findings that the **type and field of surgery** (planned surgery vs. emergency surgery; orthopedic surgery vs. accident surgery) represent <u>influencing factors</u>, as they affect, which e-health function is required and if there is even enough time to use them. For example, while in planned surgeries enough time exists to check the EHR of a patient, in emergency surgeries the time to check the emergency data record is limited. If the emergency is then especially in the accident surgery, the case can happen that there is no time at all to check the emergency data.

4.4.3 Implications from the Australian and German Ethnographic Studies

The findings of the Australian ethnographic study and the German ethnographic study have shown that in both hospitals exit a lot of similarities and differences in the context of hip and knee surgeries. The identified important factors of a surgery, which are relevant for the context of this research, are mostly comparable among the hospitals. Further, in both hospitals platform centric thinking exists so far, even though to a different extent. A major difference encompasses the way, how the documentation is done. While the Australian hospital focuses mostly on paper-based approaches, the German hospital conducts the documentation mostly electronically. In addition, the German hospital employs hook holders, while the Australian hospital prefers the application of tools here. Moreover, while the German hospital uses a preparation room for preparing the patient for the surgery, the Australian hospital performs the anesthesia in the operating room directly. There are also differences in the procedure regarding the X-rays and the planning of the prosthesis size.

The Australian hospital looks currently on an e-health strategy, which also defines an e-health solution. The German hospital works on an electronic health record. The reasons are that they

can help to improve the processes and can lead to more efficiency and better treatment in hospitals. In addition, the critical paper-based approaches in hospitals can be overcome through such e-health solutions. However, such own hospital e-health solutions are typically platform centric in nature. The reason is that these hospital e-health solutions concentrate to address internal issues. In this way, they are not designed with a network centric perspective. Therefore, it will be not possible to exchange health information among different healthcare players, because such hospital solutions only help to act across departmental boundaries. The national e-health solutions can help, but they must be considered and integrated into the own hospital e-health solutions and also in the hospitals' processes, technologies and people. In turn, because such national e-health solutions are currently not being designed with a network centric perspective on a global scale, an unhindered global health information exchange among e-health stakeholders will be still prevented.

However, even if these national e-health solutions can help the hospitals for the health information exchange among e-health stakeholders nationally, there exist several examples, why both hospitals are not ready at all so far. Some examples are presented in the following. Firstly, the processes are currently not aligned for the new national e-health solutions. Though, this is very important, because it must be precisely clear, when and where the health data of the patient are readout from the national e-health solution or when and where the new health data are uploaded into the national e-health solution by the medical staff of the hospital. In addition, the issue of patient consent must be considered in such processes. Secondly, especially the German hospital has to establish the necessary infrastructure. Currently, the new card terminals are not implemented hospital wide. They are only available in the registration area, because here the enrollee data, which are stored on the eHC, need to be readout. However, as soon as the medical functions are available, this situation must be changed. Thirdly, while speaking to the medical staff, it comes up that they are experts in their field of work; however, they are less informed and have minor knowledge about their national e-health solution so far. Finally, even if the national e-health solutions will help the medical staff in specific cases, the overall enthusiasm is not appreciable at the moment.

Overall, it can be seen that there exists the same problem on the micro level as on the macro level of the study. The e-health solutions on a single stakeholder and national level are suboptimal, if they only address internal issues and are not being designed with a network centric perspective. Therefore, the importance of this research is further confirmed. In order to investigate how to realize an appropriate e-health design on a macro level, it is important to understand how to transfer different national e-health solutions to other countries and thereby

to develop a global e-health solution. Further, the transfer of one suitable national e-health solution to other countries is one way, how countries can implement a national e-health solution with a global/network centric perspective and to avoid the risks of an own development. In this way, also the single stakeholders benefit, if they consider and integrate the national e-health solutions into their own e-health solutions and also into their processes, technologies and people.

Therefore, it can be concluded that for the single stakeholders, own e-health solutions are not an issue to concern as long as the national e-health solutions are designed with a global/network centric perspective and they are considered and integrated into their own e-health solutions and also into their processes, technologies and people. In doing so, the single stakeholder is able to exchange health information with the other e-health stakeholders around the globe and has as well an own e-health solution, where own generated health data also can be stored. However, what must be also clear is the fact that the national e-health solutions have to meet the requirements of these single e-health stakeholders (e.g. hospitals including their emergency doctors, surgeons, nurses and anesthetists) including the provision of the needed e-health functions (e.g. emergency data record and EHR), because otherwise the necessary health data can still not be exchanged.

4.5 Summary

Firstly, this chapter has presented the revised conceptual framework. This conceptual framework is extended with numbers, which help to allocate the findings of the diverse data collection methods to the different views of the study.

Secondly, this chapter has mentioned essential details about the case study interviews conducted in Australia and Germany. In this way, an overview of the 32 Australian interviewees and 36 German interviewees was given. Further, thematic analysis was presented as method used for analysis of the interview data. The three a priori themes were key factors, barriers and facilitators. The key results of the interviews were presented for each focus (i.e. national, transfer, global) in a separate table. Within each table, the findings were separated for each country and were assigned to the a priori themes as expected findings or emerging findings. Further, the emerging themes were identified and outlined for each focus, which are: "special cases" (national), "environment" (transfer) and "knowledge/exemplars" (global). Moreover, based on all key findings, the significant findings, such as laws, healthcare systems, culture and medical standards were identified and mentioned.

Thirdly, the results of the 129 Australian questionnaires and 129 German questionnaires were presented. They were analyzed using Microsoft Excel. It was shown that overall only a few participants are informed about the e-health solution of their country. Furthermore, it was stated that 46 % of the 52 informed participants think that the transferability of e-health solutions across countries is possible. In addition, there was overall no clear tendency visible that a global e-health solution is seen to be possible in the future. Moreover, it was presented that informed participants, who think that the transferability of e-health solutions across countries is possible, also have a very high tendency to believe on a global e-health solution in the future and the other way around.

Finally, the findings of the ethnographic study in Australia and in Germany were presented. In both countries, the ethnographic study was conducted at a hospital. In Australia, the chosen hospital was a private hospital. In Germany, the selected hospital was a public hospital, where the mission statement is oriented on the Christian anthropology. The results have shown that there exist similarities and differences in the context of hip and knee surgeries among the chosen hospitals in Australia and Germany. Further, it is mentioned that e-health solutions on a single stakeholder and national level are suboptimal, if they only address internal issues and are not being designed with a network centric perspective. Therefore, it is stated that the transfer of one suitable national e-health solution to other countries is one way, how countries can implement a national e-health solution with a global/network centric perspective, which is in this way likewise beneficial for the single stakeholders, if they consider and integrate the national e-health solutions into their own e-health solutions and further into their processes, technologies and people.

CHAPTER 5

5. Discussion

Firstly, this chapter discusses the interview findings gained through the case study in Australia and the case study in Germany. Secondly, this chapter conducts the triangulation of the findings achieved through the case study interviews, the case study questionnaires as well as the ethnographic study. Thirdly, three further useful facilitators are presented, which can help for the realization of a successful transfer of a national e-health solution. Fourthly, the key lessons learned from this study are stated. Finally, a summary of this chapter is given.

5.1 Discussion of the Interview Findings

This section discusses the interview findings, which are already presented in section 4.2.2. Firstly, the key findings regarding the Australian and German national e-health solutions are debated. Secondly, the key results concerning the transferability of e-health solutions are discussed. Thirdly, the key findings about network centric healthcare are argued.

Generally, the same procedure is used for each focus. In the first step, an overall statement is given, what the Australian and German interviewees think about the respective topic. In the second step, the key findings are discussed. This includes, among others, a comparison among the Australian and German interview results. In addition, the facilitators are generally checked regarding their potential to overcome the corresponding barriers. In the third step, the corresponding emerging theme is evaluated and details are presented.

Beside this general procedure, it should be noted that for the transfer focus also a discussion is given in order to answer which e-health functions, ideas and approaches can be transferred across countries. In addition, for the transfer focus, the results of the SWOT analysis as well as the advantages and disadvantages for the different stakeholders are presented.

During this discussion, the findings of the different focuses are also contrasted and discussed. Further, in order to support the discussion of the findings, direct quotes of the interviews are applied. For each statement, the specific code of the interviewee is given (see section 4.2).

Starting with the national focus, the Australian interviewees were overall cautious in the statements or unable to give a comment, when they were asked, what they think about their national e-health solution. One of the reasons is surely that the national e-health solution was not available at the time, the interviews were conducted. Nevertheless, various examples of statements are presented in the following, sorted from positive to negative.

"I think what NEHTA is doing is a great opportunity for all Australians to have a clinical health record. It will offer amazing continuity of care that this country has been lacking for many years. Furthermore, as I have a vested interest in the growth and success of e-health, NEHTA is a wonderful opportunity for e-health to take a more significant role in personal, local hospital, and state health levels." [A-PRH-IT3]

"It is quite an ambitious plan, which, if implemented well, it would be very beneficial to citizens in Australia." [A-GD-IT2] *"It helps with providing better care for the patient in terms of speed of access to the information as well as accuracy and completeness of the information."* [A-GD-IT2]

"I think it's very ambitious, and would be fantastic if it would, if it works the way they say it's going to work." [A-VHAL-M]

"So right now I think we're in a state of high flux because we're going to have this big program in 12 months. We're gonna do something in 12 months that I don't think any other country decided to do, both in terms of scope, it's a personally controlled electronic health record. It's all about the consumers and in speed it's going to be kicking off in 12 months time. Um yeah it's gonna be big, but interesting." [A-EHIO-EH2]

"It is going to take some time to set up the e-health solution. Everything takes time!" [A-MPP2-D]

As can be seen on these examples, some people believe in the advantages of the Australian national e-health solution, but it is quite unsure how the e-health solution will work and will be implemented. On the other side, the German interviewees see their national e-health solution overall more positive. However, in order to show a full picture, various examples of statements are mentioned in the following, sorted from positive to negative.

The electronic health card is a necessary modernization of the healthcare system, which makes patient care safer, easier and faster. [G-FG-ME1] (Translated from German to English)

"I mean, it's probably quite easy for a doctor to be able to access all my patient history, all my data on former illnesses on, I don't know, maybe also side effects between them, possible medications. I think it's a good development all in all." [G-C3-C]

"The e-health solution might help to accelerate information exchange and will provide better informed stakeholders. But the risks that arise, like privacy and security risks are still not addressed adequately." [G-PUHIC1-IT]

"An electronic system would increase transparency in general and is more likely to reduce costs. However, an initial investment into hardware and training of the medical staff needs to be done." [G-SAG-M]

"Actually, I don't have a lot of experience so far with the e-health in Germany um. I know that a lot of things are on the card um, but I don't know a lot about the functions. However, I know there is a big plan behind it and there will come a lot of things in the future, in the next future." [G-PC-M]

"No I think it's over engineered. Over engineered and not feasible to be implemented due to the complicated e-health infrastructure or due to the complicated stakeholders involved in Germany." [G-GD-M1]

Based on these presented German statements, it can be seen that some people perceive the benefits of such an e-health solution, while others see problem regarding security and the amount of stakeholders involved. By comparing the Australian and German interviews, German interviewees show a higher tendency to think positive about the national e-health solution. Further, Australian interviewees show a higher tendency for not answering this question as they do not know. This can have several reasons, but one reason can be an insufficient enlightenment of the people. It should be noted that in both countries, the national e-health solution was not available, while conducting the interviews.

Looking now on the findings in table 10 (see section 4.2.2.1), the first thing to be noticed is that for both countries, the a priori theme "key factors" provides fewer findings and further with considerable less frequency than the other two a priori themes, namely "barriers" and "facilitators". This fact indicates that the Australian interviewees as well as the German interviewees have answered the corresponding questions more in an emotional way, namely they see issues as a "barrier" and/or "facilitator". In addition, it should be noted that for both countries no emerging findings are provided for "key factors".

Going more into detail, "cost-benefit" is mentioned as expected finding for "key factors" in both countries. This is understandable, because Australia and Germany have to deal with rising health expenditure. Further, as presented in section 2.2.5, both countries have decided to develop and implement an own e-health solution, which brings along high investment

costs. Therefore, it is important for the success of the respective national e-health solution that it provides benefits as well, which can lead to cost saving on the other side. This is especially a problem for Germany so far, because the implementation is delayed for several years now. At the end, this means that "cost benefit" is a key factor that if absent is a "barrier" and if present is a "facilitator".

For "barriers", an interesting fact is that the expected and emerging findings are mostly similar for the Australian and German e-health solutions. In the following, the focus is first on the expected findings and then on the emerging findings. The most mentioned barrier by Australian interviewees is "insufficient enlightenment of people", followed by "lack of data protection/data security/privacy". On the German side, the most and second most mentioned barriers are the same aspects as presented on the Australian side; however, the order/frequency is the other way around. This is reasonable, as data protection, data security and privacy has an extra high priority in the German society. The next three barriers mentioned are for both countries the same, which are "amount of costs", "lack of acceptance" and "insufficient involvement of the stakeholders"; however, the frequency is different among the countries. Overall, this means that the five most cited expected barriers are for both countries the same, merely the order is slightly different. As emerging findings, "change of government" and "too many stakeholders involved" are provided for both countries; however, the order again varies. In the following, the barriers are further explained.

For "insufficient enlightenment of people" following selected statements are provided by Australian and German interviewees:

"I don't think that they've really been communicating with the citizens of this country around e-health and its benefits and perhaps providing them with a precursor to the personally controlled e-health record." [A-GD-M]

"There is a lot of information available on the web, but little effort is made to inform anyone beyond those already interested." [A-SG-M] "I think this is deliberate since the timelines are so tight and they don't want to draw too much attention until closer to provide results." [A-SG-M]

"I think they don't do enough. I mean, I haven't seen a lot of campaigns or TV ads or anything about it or I haven't read a lot about the campaigns. I think that more could be done of course and especially more to convince people about the security of the system." [G-C3-C]

"There was no real discussion before plans for the solution were finished. Not enough information was brought to the public." [G-PUHIC1-IT] *"The solution needs to be marketed better by the federal government as the main initiator, benefits must be clear to the society. Possible risks must be addressed openly, and discussed possibly on the basis of an open implementation."* [G-PUHIC1-IT]

Based on these examples, it can be seen that the enlightenment of people is neglected by the government and the health insurance companies so far. Even if the e-health solutions are not implemented yet in Australia and Germany, it is essential to prepare the general public, but also the other stakeholders for what is coming soon. Otherwise, people start discussions and speculations are spreading. Of course, discussion cannot be avoided as interests differ and they are important in one sense, but it is important that discussions are not driven by lack of knowledge. Further, it is important that the federal government stands behind the e-health solution, because political discussions in combination with insufficient enlightenment of people can lead to suspicion and uncertainty among the citizens, as can be seen in the German case. As mentioned by a member of the German Bundestag:

The discussion has lead to suspicion and uncertainty among the citizens. This is a bad precondition for acceptance and support. [G-FG-ME1] *(Translated from German to English)*

By looking on the barrier "lack of data protection/data security/privacy", the Australian and German interviewees have given following selected statements:

"The thing when I did some work on this and had a good look at it, it's interestingly that uniformly consumers talk about data privacy and the importance of it, but when you look at the actual implementation research, they never use it. Less than one percent ever applied any access controls. And I just have the feeling, the classic you know, you wouldn't ask, you wouldn't say, no, I don't care about my privacy. If anyone asks you, it becomes the most important thing, but in reality, I don't think we care that much." [A-EHIO-EH2]

"I think that is um one of the major issues at the moment with e-health, it is ensuring that patient privacy and security is ah is very well protected and Australians are very ah suspicious of governments, who collect data about their private life, whether it would be banking data or financial data or health data, etc. So the population of Australia would very much need to be convinced that this is very secure and their privacy is fully protected." [A-GD-M]

Data protection must have the highest priority. Also the right of informational self-determination. [G-FG-ME1] (Translated from German to English)

"Yeah, as I said before, it has to be, I mean, if you're not able to ensure like a really high degree of security, you have a barrier, you cannot implement it." [G-C3-C]

There will never be a one hundred percent data security. This is true for everything. However, the safeguards must be in line with the latest technology. [G-PUH2-D3] (Translated from German to English)

"Yes, especially in Germany the concerns regarding data security are very high and might be the main obstacle in the implementation of the system." [G-SAG-M] "Germans are obsessed about their private data and information. Although sharing it with Google, Microsoft, Facebook, and other professional data collectors." [G-SAG-M]

As already know, the lack of data protection/data security/privacy is considered in both countries as a major barrier. However, the statements given have reflected the general perception of this issue among all interviewees, namely that data protection, data security and privacy play an even greater role in Germany than in Australia.

The third most mentioned barrier for both national e-health solutions is the "amount of costs". As previously stated for the key factor "cost-benefit", both countries are confronted with steadily rising health expenditure. The own development of the national e-health solution and its implementation tighten this situation even more. Further, a national e-health solution can also mean that the different stakeholders like healthcare providers have to invest money for the necessary equipment. This is especially in Germany the case, because the telematics infrastructure needs to be implemented first. Further, as health insurance companies are also confronted with investment costs, higher premiums for enrollees can be the result. Therefore, this issue is definitely a barrier for the success. As commented by one of the interviewees:

"I mean if it's too expensive, it's a barrier definitely. And the patient shouldn't be responsible for paying it. I mean, it must be somehow financed by the government or by their insurance companies. It shouldn't be on the costs of the patient." [G-C3-C]

The fourth most stated barrier is the "lack of acceptance". Of course, if people like healthcare providers and patients have no trust in the solution respectively they do not accept it, the solution will have no success. This may be the result of e.g. "insufficient enlightenment of people", "lack of data protection/data security/privacy" and "amount of costs".

The fifth most provided barrier is "insufficient involvement of the stakeholders". This is reasonable, because an e-health solution is used by several stakeholders and therefore they need to be involved in the development and implementation of the respective e-health solution. Otherwise, there is the risk that these stakeholders will not accept and consequently will not use the solution. An interesting point to emphasize is the fact that interviewees of both countries have mentioned the emerging barrier "too many stakeholders involved", which stands in contradiction to the former issue. This shows that a balanced level of stakeholder involvement is important for the success of a national e-health solution. Following selected statement explains this dilemma:

"I think they've consulted probably a bit too much. Um and tried to make everybody happy." [A-EHIO-EH2]

By focusing now on the "facilitators", a comparable picture like for the "barriers" is given. The first three most stated expected facilitators are the same for both countries, only the order/frequency differs. In detail, the most common facilitator is "enlightenment of people". In the context of the Australian national e-health solution, the second most cited expected facilitator is "bring the stakeholders on board", followed by "ensure data protection/data security/privacy". In the context of the German national e-health solution, the second and third most mentioned expected facilitators are the same as presented for Australia, but in reverse order. In addition, it should be noted that "training" and "use best practices" are expected facilitators, which interviewees of both countries have mentioned. However, again the sequence/frequency varies. No similarities exist for the emerging findings.

Based on this, it can be seen that "enlightenment of people" needs to be ensured, as it helps for the success of a national e-health solution. There are several ways how enlightenment can be realized. The government and further responsible people/organizations have recourse to multiple mediums. They can make campaigns, TV ads and/or they can distribute brochures. Furthermore, they can use social networks for providing information to people. Important is to provide the information and to show the benefits of such an e-health solution. Following statements illustrate this issue:

"I think they just need to be honest about what the real core of e-health is about, so they need to be upfront about the advantages of e-health. So they, governments tend to push a message they think is going to eventually lead to a vote for their government instead of just being honest and saying this is what we really get out of it as a community, because if it's a real benefit for the community, then people will like it anyway." [A-PRH-IT2]

"I think that should really advertise about ah the benefits of such a solution to the general public." [A-PRHIC-IT]

Moreover, it is important that people get details about how data protection, data security and privacy will be ensured. This means that these issues need to be insured, but have to be also communicated to the community.

"Well, I think there needs to be much more of a focus on the privacy and security in the concept of operations document that is been um issued and I think there also perhaps needs to be some ah communication with the community on how their records will be protected and how their privacy will be protected." [A-GD-M]

The facilitator "training" is also an important aspect, because a national e-health solution will change the processes in the medical field. Therefore, it is important that healthcare providers, but also enrollees will be trained on the solution. This can increase the acceptance and also help in order to avoid the e-health solution will cause performance problems.

Further, "use best practices" is an important facilitator, because it is not necessary to develop an e-health solution from the ground and always to reinvent the wheel. If countries decide to develop their own e-health solution, it is at least recommendable to consider best practices from other countries. In this context, also the transfer of a national e-health solution from one country to another country can be mentioned. A transfer of a successful national e-health solution from one country to another country is also a way, how countries can use best practices. In this context, the following statement was provided by a German interviewee:

"If there's a good standard like kind of a leading practice from another country, why not just look at that example and try to, not to copy it, but try to use the technology, try to use the experiences they made. So yeah, I would say, if there is a good example, try to at least share the knowledge with the other countries and why not try to implement a common system. It could be also a good possibility." [G-C3-C]

On the Australian side, another facilitator is "step by step approach". This approach is very important, because a national e-health solution, especially if several e-health functions are involved, needs to be implemented stepwise. In particular, such an approach is known from the implementation of the German national e-health solution.

On the German side, the emerging facilitator "define project goal across the major political parties" is stated. This issue helps for the barrier "change of government". If the project goal

of an e-health solution is accepted by the major political parties, a change of government in the new legislative period will usually not lead to a rejection or review of the whole project.

Based on all findings, which are mentioned at the national focus, it can be seen that the Australian and German interviewees see several aspects in a similar way. Further, they have provided several facilitators, which can help to overcome the barriers. For example, "enlightenment of people" can solve the barrier "insufficient enlightenment of people", "bring the stakeholders on board" can tackle the barrier "insufficient involvement of stakeholders" and "ensure data protection/data security/privacy" can help for the barrier "lack of data protection/data security/privacy".

By looking on the national focus and considering the domains of network centric healthcare, it can be seen that the presented key results mostly cross the physical and cognitive domains. In this way, it is shown that the success of a national e-health solution does not simply depend on the technology and e-health solution itself, because the processes and people have certainly a big influence.

At the end of the national focus, the discussion targets the emerging theme, which is "special cases". The aspects mentioned in this context do not affect the success of the whole national e-health solution. One of the issues is "rural areas". The reason is that these districts can have different preconditions and therefore can require special considerations in regards to a national e-health solution. However, this issue varies from country to country. In Australia for example, rural areas also include dessert landscape, where IT infrastructure and broadband connection is not or only in part given. To change this situation, a tremendous investment is necessary and wireless as well as satellite technology can help here. Furthermore, the density of healthcare providers is very low and consequently the chance to get medical treatment is limited in these areas. In addition, it is not ensured that the healthcare providers have the same knowledge from the medical and IT point of view. In Germany for example, the problems in rural areas are comparatively smaller than in Australia. Only a few German interviewees see problems for German rural areas concerning the national e-health solution. The expressed concerns include slow Internet connection and necessary investments. In the following, some selected statements of interviewees are listed, which underline the fact that "rural areas" is a special case and can be a problem in specific countries.

"In Australia, rural areas tend to be quite remote and the population spread in those areas is ah is small, so therefore it could be quite costly having electronic health systems delivered up to small communities and that sort of thing and that is a challenge in Australia." [A-GD-M]

"Well, I think that um one of the things that you could look at would be for instance um wireless or satellite technology rather that ah perhaps having a um fibre optic, which is under the NBN program." [A-GD-M]

"So unfortunately Australia's one of those countries where, you know, the vast percentage of land is not inhabited so to be able to put infrastructure across such massive areas for such a small amount of people is a challenge and not very cost effective." [A-PRH-IT2]

"I mean data connections could be a problem, but it's also highly developed already. So I think that's not a problem for that. No, I don't see any problems." [G-C3-C]

"No, infrastructure (IT as well as doctors and other infrastructure) is available even in the rural areas in Germany." [G-PUHIC1-IT]

Nowadays, a rural doctor's practice has also IT. [G-MPDE1-DE] *(Translated from German to English)*

They also have IT in rural areas. [G-FG-ME2] *(Translated from German to English)*

Beside "rural areas", "healthcare specialists" and "visitors/tourists" can be further "special cases". For example, a healthcare specialist like a cardiac surgeon may require other e-health functions respective special health information of patients than the national e-health solution actually provides. Therefore, this issue represents a barrier in this specific context. Moreover, visitors/tourists are might be able to use the e-health solution in the future. However, language can be a barrier in this regard.

The next part of the discussion targets the transfer focus. The majority of the interviewees, i.e. the Australian interviewees as well as German interviewees, think that the transferability of e-health solutions across countries is possible. However, the interviewees see several "key factors", "barriers" and "facilitators", which influence the transferability of e-health solutions. These findings were already presented in table 11 (see section 4.2.2.1) and will be discussed in the following paragraphs.

Generally, for "key factors" a similar picture is shown than at the national focus. This a priori theme provides fewer findings and further with considerable less frequency than the other two a priori themes. This fact indicates again that the interviewees have answered the corresponding questions more in an emotional way. In addition, it should be noted that also at this focus, no emerging findings are provided for "key factors".

In detail, the "economic background" is one of the expected "key factors" which influences the transferability of e-health solutions and which is mentioned by interviewees of both countries. Even if a transfer of a national e-health solution avoid own development costs, it still requires the implementation of this transferred e-health solution. This can be very costly, especially when the e-health solution requires the implementation of a telematics infrastructure. Further, receiving countries cannot expect to get the national e-health solution for free, because transferring countries might have an interest to get parts of their development costs back. Therefore, the economic background is a "key factor", which can result in a "barrier", if the transfer is very costly and the receiving country has a lack of financial resources.

Another expected "key factor" stated by German interviewees is the "scope of transfer". This means that it makes a difference e.g., if the transfer of an e-health solution only encompasses an emergency data record or if the transfer of an e-health solution includes several e-health functions together with its required telematics infrastructure.

A further expected "key factor" provided by German interviewees is the "win-win situation for both countries". This means for the receiving country a national e-health solution, which is e.g. affordable and provides benefits, while the transferring country gets a compensation for its efforts. If this can be ensured, it serves as a "facilitator", but if absent, it represents a "barrier".

In the next step, the "barriers", which influence the transferability of e-health solutions, are focused. In this context, first the expected findings and then the emerging findings are discussed. What needs to be pointed out is the fact that the Australian interviews and the German interviews have provided six equal expected "barriers". In other words, six of the seven most mentioned expected "barriers" in the Australian interviews and the German interviews are the same issues. However, the order/frequency is essentially different, as can be seen in table 11 (see section 4.2.2.1). These expected barriers are "different cultures", "different laws", "different technical preconditions", "different healthcare systems", "different politics" and "different languages". As emerging findings, "different medical terminology" is mentioned by interviewees of both countries. In the following, the barriers are further explained.

The literature review has already shown that the communication among "different cultures" can be very challenging (see section 2.4). Further, as culture has an effect on medical treatments and procedures, but an e-health solution has to fit to the respective processes,

different cultures are definitely a barrier for the transferability of e-health solution. However, it should be noted that this depends on the respective countries, as deviations among cultures can be huge, but also extraneous or negligible.

The barrier "different laws" is far reaching. An e-health solution must be legal and compatible with the current laws. However, as shown on the example of Australia and Germany, even data protection/data security/privacy laws differ among countries. This can be a real problem. For example, if an e-health solution is intended to be transferred from China to Germany, where security is a very important factor and laws are very strict in this respect, the transfer might be never happen or multiple adaptations are required.

"Different technical preconditions" are also a problem for the transferability of e-health solutions across countries. For example, if a developing country like Ghana or Sierra Leone wants to receive a national e-health solution, the lack of IT infrastructure can be a problem. Certainly, these are extreme example, but they illustrate this issue clearly.

As the literature review has pointed out, healthcare systems are different (see section 2.1). Among others, there exist differences, how the system is driven (e.g. private vs. public), how the system is financed and how enrollees are insured. This issue also represents a barrier for the transferability of e-health solutions. For example, to transfer the German eHC solution to a country like the U.S., whose healthcare system is mainly private driven, can be very challenging. The reason is that such an e-health solution requires, among others, the implementation of a very costly national telematics infrastructure. However, private organizations can have other priorities and may not want to participate. In such cases, the question "Who drives the transfer?" can be one of the key questions.

"Different politics" have also a negative influence on the transferability of e-health solutions. Before a national e-health solution can be transferred from one country to another country, both federal governments have to approve this project. Further, the necessary laws must be created or adapted in the receiving country. Though, if the two involved countries have different politics, their priorities can be different. In addition, different opinions and/or conflicts can exist among the two federal governments, which can prevent the further collaboration.

The next barrier "different languages" is also an essential aspect to consider. Languages can vary across countries and their people. On the other side, a national e-health solution has to deal with health data and therefore several data fields and instructions exist. Further, specific

e-health functions like e-prescriptions can include drop-down fields with predefined values/medicines. If an e-health solution with such functionality needs to be transferred across countries, where diverse first languages appear and no common language can be detected, problems are bound to occur. For example, if the German e-health solution is intended to be transferred to Australia, the healthcare providers in Australia may not understand the German instructions. Consequently, the transfer cannot be realized without fundamental changes including the adaptation of the e-health solution to the other language. However, this also causes problems regarding further development. Independent of the transfer, there will be also the problem that a useful cross-border data exchange cannot happen among such countries, where the first languages are different and no common language can be found. Going back to the example given, this means that an Australian healthcare provider may not be able to read the medical history of a German patient, as the health data are provided/stored in German.

As emerging barrier, interviewees of both countries have mentioned "different medical terminology". One problem which can happen in this context and which is already known from the language barrier is the subject of predefined data fields. If the national e-health solution is based on another medical terminology than common in the receiving country, this e-health solution is useless at that stage and cannot be transferred directly, because the healthcare providers in the receiving country will not understand the predefined terms.

Now the "facilitators", which influence the transferability of e-health solutions, are targeted. Similar to the "barriers", fifth of the seven most mentioned expected "facilitators" in the Australian interviews and the German interviews focus the same issues. However, the order/frequency is basically different, as can be seen in table 11 (see section 4.2.2.1). These expected "facilitators" are "similar laws", "similar healthcare systems", "similar IT infrastructure", "similar culture" and "same language". As emerging "facilitators", "local adaptations of the e-health solution must be possible" and "similar medical standards" must be pointed out, because these aspects are mentioned by interviewees of both countries.

"Similar laws" in the transferring and receiving country will positively influence the transferability of an e-health solution. In this way, the e-health solution is legal in both countries. Further, if the laws regarding data protection/data security/privacy are similar, the e-health solution can be used directly. In this context, following useful statement was given:

"Probably it's not the same, but kind of a similar view on data protection and the view on what is actually allowed to store, which information is allowed to store and which information is not allowed to share, for example." [G-C3-C]

"Similar healthcare systems" in two countries will help for the transferability of the e-health solution among these countries. For example, if in both countries the citizens have public health insurance by law then the transfer can be proceed by the federal government and the responsible organizations with the outcome that everybody can use it. Further, the former implementation plan of the transferring country can serve as best practice. Even if the literature review has shown that no healthcare system equals exactly the other healthcare system, it is at least helpful for the transfer, if the healthcare systems of both countries belong to the same category/type, i.e. mostly private, mostly public or two-tier.

"Similar IT infrastructure" in both countries affects the transfer positively, because the necessary IT equipment is already implemented sufficiently. For example, this can encompass the required computer hardware and nationwide Internet access.

To have a "similar culture" in both countries can assist for the transferability of e-health solutions. Because culture has an impact on how medical treatments and procedures are conducted, a similar culture will help that the e-health solution, which is developed for the needs of one country may also fit in the other country. However, it is important to note that there exist other aspects, which also influence the medical treatments and procedures.

If two countries use the "same language", the transferability of e-health solutions can be easier. The e-health solution plus its instructions and data fields are already geared to that specific language. Also the stakeholders in both countries can communicate adequately and share their experience. It is important to note that "same language" can be also achieved, if two countries with different first languages agree to use a common language. However, this in turn depends on the specific language, in which the e-health solution was developed. For example, if Germany is able to use an e-health solution, which is developed in English, then there is no problem in this regard. On the other side, if an e-health solution is developed in German, the chance to get a common language "German" with another country is limited. In this context, following statement was given by a German interviewee:

"If you have one English country and one other speaking country of course you have to find a compromise which language is the standard, because you have to find a standard. But ah I think for Australia and Germany, when you look at these two countries, specific countries, I think German would not be the standard language. It would be more English, because it's more the global seen language." [G-PC-M]

The idea of the interviewee is reasonable, if English is in both countries prevalent or in other words, if the users of the e-health solution in both countries are able to speak English. However, this suggestion also assumes that the e-health solution is developed in English.

The emerging facilitator, "local adaptations of the e-health solution must be possible" is an important aspect in the context of the transferability of e-health solutions. This means that an e-health solution has to be designed that specific needs of the receiving country can be considered. For example, the German e-health solution is designed in a way that it uses one telematics infrastructure, but allows several e-health functions. A receiving country, which has a problem with one of the e-health functions, be it because of local cultural issues or ethical issues, can easily remove single e-health functions from the transfer. Further, as healthcare systems of countries are different, even slightly if they relate to the same category/type, such possibility increases the chance of a successful transfer, because national specificities can be considered.

The last "facilitator" used for discussion is "similar medical standards". Medical standards encompass the level of care, which depends, among others, on the available medical equipment like computed tomography (CT) and magnetic resonance imaging (MRI). Based on this, it is conceivable that "different medical standards" represent a "barrier", while "similar medical standards" in both countries serve as "facilitator" for the transferability of national e-health solutions. The reason is that if a country has a low medical standard, then an e-health solution is useless for this country at that stage, because the problems and priorities lie elsewhere.

Based on all findings, which are mentioned at the transfer focus, it can be seen that the Australian and German interviewees see also here several aspects in a similar way. Further, they have provided some facilitators, which can help to overcome the barriers. For example, to establish "similar laws" can serve for the barrier "different laws" and to follow "similar politics" can help for the barrier "different politics". However, it should be noted that the stated "barriers" and "facilitators" represent a general overview respectively a checklist, because which of them really occur and have an influence on a specific transfer example, depends on the chosen countries and the specific national e-health solution. In other words, this means that specific "barriers" can be avoided beforehand by choosing the right countries and the right e-health solution. For example, if Australia and U.K. is chosen, the language barrier will not exist, while among Brazil and Germany, the language barrier can be a problem. This approach is essential to consider, if some of the identified barriers represent

knockout barriers, i.e. it is not possible to overcome these barriers, because required adaptation/changes/solutions are not reachable; however, this needs to be investigated in further studies.

How the selected e-health solution and its underlying e-health functions may have an influence on the transferability will be discussed more detailed in the following, as it relates to one of the sub-questions of the research question, namely "Which e-health functions, ideas and approaches can be transferred across countries and/or different healthcare actors". In general, the results of the Australian and German interviews have indicated that technically all e-health functions can be transferred across countries. In other words, based on a technical point of view, the transfer of a national e-health solution from one country to another country is possible, independent of the underlying e-health functions. However, by looking on the transfer focus and considering the domains of network centric healthcare, it can be seen that the presented key results mostly cross the physical and cognitive domains. In this way, it is shown that the transferability of national e-health solution does not only depend on the technology including the e-health solution and its underlying functions, because processes and people have definitely a crucial influence. And this is exactly the point to highlight and how to answer the sub-question of the research question. In general, all e-health functions, ideas and approaches can be transferred across countries and/or different healthcare actors. However, the identified "key factors", "barriers" and "facilitators" influence, how easy or challenging it is to transfer. For example, if two countries have totally "different cultures", then the way, how they deal with medicine can be completely different. Technically, it is possible to transfer a national e-health solution including e-prescriptions; however, because the e-prescriptions are may not required in the receiving country, they are a problem for the transfer. Another example targets "different laws". If in the receiving country no law exists, which allows the electronic storage of the entire medical history of patients, an electronic health record can only be transferred, if the laws in the receiving country are adopted/changed or if the national e-health solution is transferred without the EHR module. Finally, in order to support the facts given in this context, some selected interview statements are provided.

"Well, you may not have the freedoms of ah democracy in all countries that would allow you to personally control your e-health record for instance." [A-GD-M]

"I believe they're all possible, I just think some of them are easier than others." [A-GD-IT1]

"I think if your countries are similar enough, you could transfer whole solutions. So everything, if the culture of the country is similar enough for them to accept it." [A-VHAL-M]

"The approach, I mean the approach and the idea are all transferrable between all countries." [A-PRH-D3] "Cause I see e-health solutions as providing better care for patients. That's why I think it's all applicable cause of ease of accessibility of the information that's needed to come up with a diagnosis to treat a patient." [A-PRH-D3]

"It's possible, but it depends on the country how much of changes are they willing to do." [A-U3-ABIT3]

"I think it's all of those, but I think it should be elective in a sense that a country can either take all or they may take just the first three. Because at the end of the day, some more countries have more resources, you know, population types, whatever. You know, they may not want to take everything at the same time. It should be, you can go at your own speed." [A-U3-SBIT3]

"I think that only the more functions it has, the more complex it gets. So if you have lesser functions, it's easier to really transfer across the nations." [G-C3-C] "All can seriously be transferred." [G-C3-C]

The transferability is given. In principal, there is no obstacle. However, the other party has to know, what they want. [G-GD-M2] (Translated from German to English)

"All e-health functions can possibly be transferred across countries. Based on cultural differences, some e-health functions can probably be transferred easily across countries while others will not be accepted." [G-PUHIC1-IT]

All e-health functions can be transferred. Perhaps it is restricted due to cultural, religious or ethnic conditions. [G-PRH-N] (Translated from German to English)

In the next step, the emerging theme of the transfer focus, namely "environment", is discussed. In general, the environment of a transfer encompasses two countries, namely the transferring country that has already a national e-health solution with specific e-health functions in place and the receiving country that want to receive the national e-health solution. As mentioned in the literature review, a national e-health solution involves several stakeholders. If such a national e-health solution wants to be transferred across countries, the stakeholders will be the same basically, but due to two countries, the number of people involved is increasing. In addition, the environment encompasses also the relationship and interaction between the stakeholders inside and across the countries. Further, depending on the specific countries, the environment can vary fundamentally, because e.g. "different

healthcare systems", "different laws" and "different cultures" exits across the globe. Consequently, the preconditions for the transfer can be completely different and therefore easy or more challenging. During the interviews, the stakeholder with the biggest impact on the transferability of e-health solutions was searched. The majority of the interviewees – in total but also in each country – see the "federal government" as stakeholder with the biggest impact on the transferability of e-health solution across countries. The reason is that the federal governments of both countries have the decision-making powers. Further, the federal government of the receiving country makes the laws and in this way influence, if an e-health solution is legal. However, depending on the receiving country and their government system, for instance dictatorship or democracy, the federal government involves the users like healthcare providers and enrollees and asks for their needs. They know that these people have to accept the solution. Moreover, this whole issue also depends on the stakeholder, who owns the national e-health solution in the transferring country. Overall, the first decision is surely on the side of the federal governments, as they, among others, have to agree to the transfer and they make the laws; however, depending on the countries and their government systems, the other stakeholders will also have a big impact on the transferability of e-health solutions. In this context, the following useful interview statements could be detected:

"Federal government." [A-PRH-IT1] "They have the biggest influence on policy and money." [A-PRH-IT1]

"Federal government." [A-GD-IT2] "Because they are able to introduce national based agreements and laws." [A-GD-IT2]

"Um probably in some ways physicians and dentists you know cause if they don't, any solution at the end of the day has to be accepted by the people who are going to use it really so. If they don't accept it they won't use it and they'll try to block it." [A-GD-IT1]

"I think um it depends a little bit on the solution and the country but I would hope it's the enrollee." [A-U3-ABIT1] "Um because it, healthcare is about helping the patient. It should be about helping the patient." [A-U3-ABIT1]

"Probably it's the government I think." [G-C3-C] "Because they have to make the laws. They have to, yeah, to also pay for it and they have to really push for the solution with the other government. I mean, organizations, they can talk to each other but they cannot make any decisions. It's only the government who can really have a common decision to really follow such a joint solution." [G-C3-C]

"Federal Governments." [G-SAG-M] "Federal Governments have to set the regulations which is important that the e-health solution can be implemented, governments also have to enforce implementation by their institutions." [G-SAG-M]

The government, of course. [G-H-IT] Finally, both. [G-H-IT] Because it is not possible to implement a nationally valid e-health solution against the resistance of a government in another country. That simply does not work. [G-H-IT] (Translated from German to English)

At the end of the transfer focus, this study looks one step further. It is now assumed that the transfer of a national e-health solution from one country to another country is conducted successfully. Further, it is supposed that both countries allow the exchange of health information among each other. Based on this situation, table 13 lists the corresponding strengths, weaknesses, opportunities and threats. Further, due to this successful transfer, the various stakeholders can be confronted with several advantages and disadvantages. Tables 14 to 21 demonstrate these advantages and disadvantages for each stakeholder. All aspects of these tables were provided by the Australian and German interviewees and are separated respectively.

Overall, it can be seen that most of the issues provided in these tables are already known from the national context. Though, this is not surprising, because a successful national e-health solution is the starting point for the transfer. After a successful transfer, the national e-health solution is available in two countries. So the main difference relates to the scale. In addition, it is also shown that the advantages and disadvantages for doctors are mostly similar, independent whether they are working in private practice or in hospitals.

The last focus to discuss is the global focus. This means that the focal point lays now on network centric healthcare respectively a global e-health solution, which means also the involvement of all countries worldwide. The majority of the interviewees, i.e. the Australian interviewees as well as German interviewees, think positive about the idea of a global e-health solution respectively network centric healthcare on a global scale. However, at the same time, most of the interviewees from each country, who commented on the feasibility, believe that the realization of network centric healthcare would be not possible, at least in the next years. Furthermore, the interviewees see several "key factors", "barriers" and "facilitators", which influence the realization of network centric healthcare. These findings were already presented in table 12 (see section 4.2.2.1) and will be discussed in the following paragraphs.

	Australian Interviews	**German Interviews**
Strengths	• Economy of scale; costs • Consistency/standardization of care • Access to medical history in both countries • Better healthcare services • Share knowledge/experience • Shorter learning curve as solution is provided	• Costs • Same standard between two countries • First step of a global e-health solution • Data are available in both countries, which increases mobility, improves preplanning of surgeries and allows enrollees to get better and faster treatment in the other country • Easier information exchange among countries • Further development can be done together • Comparison (e.g. cause of disease; risk factors) across both countries possible • Can learn from each other
Weaknesses	• Adaptation of the solution to the needs of the receiving country • Differences in structure, organization, culture, language and medical standard among countries • Lack of best practices/knowledge • Lack of maintenance and strong customer service • Data protection/data security/privacy • May not be able to address certain type of issues from the receiving country	• If transferred e-health solution is immature, other country has also problems • If solution crashes somewhere then problem in both countries • Data protection/data security/privacy • Higher risk for misuse of data • Costs • Problems can arise, if political conflicts will happen in the future • Coordination among both countries about changes and timely realization is required
Opportunities	• Improve on the solution, which already works and where the other country made mistakes • Improve sharing of information • Better healthcare delivery for patients from both countries • Bring countries closer together • Transferring country may benefit from innovations of receiving country • The reduce of costs can allows to provide healthcare to more people	• Sick people are more willing to travel to the other country • Possibility for a peaceable exchange among two countries and cultures • Better treatment and quality of care for patients from both countries, because patient data from both countries can be accessed • Life savings • Joint campaigns and share knowledge • Chance that more countries will join • Chance for a global solution in the future
Threats	• Adaptation of the solution to the needs of the receiving country • Not designed to allow local adaptations • Differences in culture, language and clinical procedures • Data protection/data security/privacy • Costs • An attack in one country can follow an attack in the other country	• If e-health solution is immature other joining countries which will also have problems • Data protection/data security/privacy • Misuse of data in both countries • Higher risk of network attacks and failures • Crash affect both countries • Risk that one country goes back to a solo run • Language barrier

Table 13: The strengths, weaknesses, opportunities and threats after a national e-health solution has been transferred from one country to another country
[The findings refer to macro view of the conceptual framework, and thereby specifically to the transfer issue (see section 4.1, figure 24, no. 3). However, to be precise, the findings in particular relate to the two involved countries, i.e. the macro, mezzo and micro view, as the findings already assume a conducted successful transfer.]

	Australian Interviews	**German Interviews**
Advantages	• Economy of scale; costs • Political achievement • Proven solution, which helps also for promotion • Better control and monitoring • More effective and efficient healthcare delivery • Learn from the other government • Gains in how to provide better healthcare • If they provide it correctly, better off, in terms of like elections • Changes in regulations of one country will affect e-health solution	• Costs • Political achievement • Proven solution • Image topic • Healthcare system is better controllable • Easier comparison of healthcare systems • Statistics possible • Deficits identifiable • Better quality of care can be achieved for people • Exchange of experience • Transparency on implementation performance • More business between the two countries • Can place own interests in the other country • Synergies
Disadvantages	• Loss of control • Costs • Protests of people • Solution may not fit in with the values of their society • Risk that the general public does not accept the e-health solution	• Loss of power • Compromises • Loss of prestige • Costs • Downgrade, if solution does not fulfill all local requirements • Maybe insufficient consideration of own interests • Question of liability • Questionable, who controls and influences the system • Risk of no success • E-health solution is more vulnerable • Problem, if transferred e-health solution is immature and includes mistakes

Table 14: The advantages and disadvantages for the federal government after a national e-health solution has been transferred from one country to another country
[PD = physical domain (process); ID = information domain (technology); CD = cognitive domain (people). The findings refer to macro view of the conceptual framework, and thereby specifically to the transfer issue (see section 4.1, figure 24, no. 3). However, to be precise, the findings in particular relate to the mezzo view of the two involved countries, as the findings already assume a conducted successful transfer.]

	Australian Interviews	**German Interviews**
Advantages	• More revenue • Better outcome • Economy of scale; costs • Help to justify their existence • Improves business case • Learn from others • Proven solution • Efficiency improvement	• Extended market • More revenue • Costs • They are more important • Can use know-how of the transferring country • Transparency on implementation performance • Statistics possible
Disadvantages	• Loss of control • Costs • Solution may not meet all requirements of the country	• Loss of power • Slower decision-making • Maintenance and further development need also agreement of the receiving country • Competition increases • Maybe will never exist in the receiving country • Maybe not necessary anymore, as one organization for both countries • Cross-border institution in addition to national institutions necessary • Institutions of both countries may not communicate with each other • Exchange across national borders necessary • More work for institution of the transferring country • More complex than just own solution • Question of liability • E-health solution is more vulnerable • Problem, if transferred e-health solution is immature and includes mistakes

Table 15: The advantages and disadvantages for the e-health institutions/organizations after a national e-health solution has been transferred from one country to another country
[The findings refer to macro view of the conceptual framework, and thereby specifically to the transfer issue (see section 4.1, figure 24, no. 3). However, to be precise, the findings in particular relate to the mezzo view of the two involved countries, as the findings already assume a conducted successful transfer.]

	Australian Interviews	**German Interviews**
Advantages	• Costs • Better access to medical histories of patients from both countries • Improved performance, because data are available from both countries • Can provide better, safer and cheaper health services • Better patient outcomes • Standardization of care • Proven solution • Opportunity to learn • Time savings	• Costs • Can provide better and faster medical care to patients from both countries, because patient data from both countries can be accessed easily and quickly • Easier health information exchange among countries • Less double examinations • Faster billing procedure, if agreement among both countries exist • Less paper flows • Known, who will pay for treatment of patients from the other country • If hospital has also a subsidiary in the other country, the same solution in the hospitals will provide cross-border benefits to the staff • Exchange of experience
Disadvantages	• Challenging to remain competitive in regards of quality of services and costs • Challenging to cope with different ways of managing the processes • Process changes required, if not fit • Hospital practice may need to be adapted • Lose control • Transparency between the countries • Because information can be written in a different language, access problems can result	• Question of liability • Patient may use medical care in the foreign country • Adaptation to a common solution maybe more costly • Data capture maybe more difficult • Guarantee of data protection/data security/privacy • Misuse of data • E-health solution is more vulnerable • Problem, if transferred e-health solution is immature and includes mistakes • Competitive pressure among hospitals of both countries • Language barrier • Misreading of data

Table 16: The advantages and disadvantages for the hospitals after a national e-health solution has been transferred from one country to another country
[The findings refer to macro view of the conceptual framework, and thereby specifically to the transfer issue (see section 4.1, figure 24, no. 3). However, to be precise, the findings in particular relate to the micro view of the two involved countries, as the findings already assume a conducted successful transfer.]

	Australian Interviews	**German Interviews**
Advantages	• Costs • Cost transparency • Can have access to own medical history in both countries • Medical record is also accessible in the other country, if healthcare providers or others ask for it • Can get better, safer and cheaper health services in the other country • Time savings • Life saving	• E-health solution works in both countries • Can have access to their entire electronic health record in both countries • Can get better, cheaper and faster medical care in the other country, because their data are available in both countries • Better information exchange with doctors of the other country • Less double examinations • Inhibition level is smaller to use treatment in the other country • Less bureaucracy to get healthcare in the other country • Not to fill out forms in a foreign language • Due to exchange of experience among the countries, solution can be faster improved
Disadvantages	• Data protection/data security/privacy • People read the information incorrect due to language issues	• Data protection/data security/privacy • Misuse of data • E-health solution is more vulnerable • Wrong data can lead to wrong treatment in the other country • Insurance rates can rise • Transparent for health insurance companies from both countries • Higher fear regarding transparent patient

Table 17: The advantages and disadvantages for the enrollees after a national e-health solution has been transferred from one country to another country
[The findings refer to macro view of the conceptual framework, and thereby specifically to the transfer issue (see section 4.1, figure 24, no. 3). However, to be precise, the findings in particular relate to the micro view of the two involved countries, as the findings already assume a conducted successful transfer.]

	Australian Interviews	**German Interviews**
Advantages	• Costs • Better access to medical histories of patients from both countries • Pharmacists see also what was prescribed in the other country • Can provide better, safer and cheaper health services • Standardization of care • Proven solution • Learn from the professions of the other country	• Reduce medication misuse among both countries • Can consider allergies and drug intolerances of patients from both countries, because patient data from both countries can be accessed easily and quickly • Can identify substance, which patients of both countries already use • Easier finding of medicine, which patients of both countries already use • Less paper flows • More secure information exchange than through paper-based prescriptions • Can provide medicine for prescriptions of the other country and get paid for them • Easier market entry in the other country
Disadvantages	• Process changes required, if not fit • Challenging to remain competitive in regards of quality of services and costs • More responsibility through available data • Solution needs to be adapted to medications, which are available	• Transparency on prices for medication • Patient may use medical care in the foreign country • Data capture maybe more difficult • E-health solution is more vulnerable • Problem, if transferred e-health solution is immature and includes mistakes • System failure means also that e-prescription cannot be used • Misreading of data

Table 18: The advantages and disadvantages for the pharmacists after a national e-health solution has been transferred from one country to another country

[The findings refer to macro view of the conceptual framework, and thereby specifically to the transfer issue (see section 4.1, figure 24, no. 3). However, to be precise, the findings in particular relate to the micro view of the two involved countries, as the findings already assume a conducted successful transfer.]

	Australian Interviews	**German Interviews**
Advantages	- Costs - Better access to medical histories of patients from both countries - Ability to get data on treatments, which patients have received in the other country - Improved performance, because data are available from both countries - Can provide better, safer and cheaper health services - Standardization of care - Better communication of doctors among both countries - Proven solution - Learn from the professions of the other country - Time savings	- Costs - Can provide better and faster medical care to patients from both countries, because patient data from both countries can be accessed easily and quickly - Easier health information exchange among countries - Better communication - Physicians and dentists of both countries can avoid double examinations - Faster billing procedure, if agreement among both countries exist - Less paper flows
Disadvantages	- Competition increases - Challenging to remain competitive in regards to quality of services and costs - Process changes required, if not fit - Practice adaptation to the solution - Loss of the EHR ownership	- Question of liability - Patient may use medical care in the foreign country - Adaptation to a common solution maybe more costly - Data capture maybe more difficult - Guarantee of data protection/data security/privacy - Misuse of data - E-health solution is more vulnerable - Problem, if transferred e-health solution is immature and includes mistakes - No double examinations possible - Language barrier

Table 19: The advantages and disadvantages for the physicians/dentists after a national e-health solution has been transferred from one country to another country

[The findings refer to macro view of the conceptual framework, and thereby specifically to the transfer issue (see section 4.1, figure 24, no. 3). However, to be precise, the findings in particular relate to the micro view of the two involved countries, as the findings already assume a conducted successful transfer.]

	Australian Interviews	**German Interviews**
Advantages	• Business in the other country • Revenue • Costs • Getting better and faster information from both countries • Increased knowledge of health risk • Benchmark • Faster and better processing of insurance claims between the two countries • Keep track of customers in more reliable manner • More information allows them to recreate more categories for pricing between the two countries	• Health insurance companies might have the opportunity to expand to the other country • Costs • More data transparency; better overview of patients • Better cost control • Better financial planning • Statistics possible • Faster access to administrative data of the other country • Faster and easier billing procedure among both countries • Standardization of billing procedure allows better information exchange among health insurance companies • Better care of people from the foreign country
Disadvantages	• Legal disadvantages • To stay competitive force them to diversify their services • More transparencies for the patient, which leads to abroad enrollment	• Loss of power • Costs • Complex billing procedure • Liable for data protection/data security/privacy • Misuse of data • E-health solution is more vulnerable • Problem, if transferred e-health solution is immature and includes mistakes

Table 20: The advantages and disadvantages for the health insurance companies after a national e-health solution has been transferred from one country to another country
[The findings refer to macro view of the conceptual framework, and thereby specifically to the transfer issue (see section 4.1, figure 24, no. 3). However, to be precise, the findings in particular relate to the micro view of the two involved countries, as the findings already assume a conducted successful transfer.]

	Australian Interviews	**German Interviews**
Advantages	• Opens the market; opportunity to expand to another country • More business, if they are the supplier • More revenue • More profit • Consistency of the solution and the required material in both countries • Costs • Suppliers of both countries learn from each other • Controlling the system	• Can get more market • More business, if they are the supplier • More revenue • More profit • Same products in both countries required • Economy of scale; decreasing production costs • Get know-how • Less effort
Disadvantages	• Competition increases • Maybe not necessary anymore • Risk of less business, if their country buys the solution of the other country • Lack of opportunities • Opens the local market	• Competition increases • Maybe not necessary anymore • Risks of market loss and less business • Question of liability, if mistakes or wrong treatments happen due to their fault • Maybe more effort, because further languages or IT systems need to be considered • E-health solution is more vulnerable • Problem, if transferred e-health solution is immature and includes mistakes

Table 21: The advantages and disadvantages for the e-health material suppliers after a national e-health solution has been transferred from one country to another country
[The findings refer to macro view of the conceptual framework, and thereby specifically to the transfer issue (see section 4.1, figure 24, no. 3). However, to be precise, the findings in particular relate to the micro view of the two involved countries, as the findings already assume a conducted successful transfer.]

Generally, for "key factors" a similar picture is shown as for the national and transfer focus. This a priori theme provides fewer findings and further with considerable less frequency than the other two a priori themes. This fact indicates again that the interviewees have answered the corresponding questions more in an emotional way. However, in contrast to the national and transfer focus, an emerging "key finding" is provided by Australian interviewees, by name "medical terminologies across countries".

The "barriers" influencing the realization of network centric healthcare are discussed next. In the first step, the expected findings are discussed. In the second step, the emerging findings are debated. At the beginning, it must be pointed out that the Australian interviews and the German interviews have provided five equal expected "barriers" or in other words, five of the seven most mentioned expected "barriers" in the Australian interviews and the German interviews target the same issues. However, the order/frequency is basically different, as shown in table 12 (see section 4.2.2.1). In detail, these expected barriers are "different cultures", "different languages", "different politics", "different healthcare systems" and "different IT infrastructure". All these issues are already known from the transfer focus and therefore will be not explained again. However, what needs to be highlighted is the fact that these "barriers" are definitely more challenging on a global scale, because these differences exist certainly across countries and there is no chance on a global scale to choose the right countries in order to avoid these barriers, because all countries are affected. Further, the Australian interviewees have mentioned the "scale of project" as an interesting "barrier". This is comprehensible, because this project involves almost 200 countries and each country has several stakeholders. For the emerging findings, so similarities exist among the Australian and German findings. Though, an essential emerging barrier is the "lack of an international umbrella organization for coordination", which is provided by German interviewees.

In the next step, the "facilitators", which influence the realization of network centric healthcare, are focused. Similar to the "barriers", but also to the transfer focus, fifth of the seven most mentioned expected "facilitators" in the Australian interviews and the German interviews are the same aspects. However, the order/frequency is different, as can be seen in table 12 (see section 4.2.2.1). These expected "facilitators" are "similar laws", "similar IT infrastructure", "get consent", "similar healthcare systems" and "step by step approach". Of these "facilitators" are "similar laws", "similar IT infrastructure" and "similar healthcare systems" already known from the transfer focus and consequently they are not explained again. The "step by step approach" is already known from the national focus, where it relates to the stepwise implementation of e-health functions. Though, in the global context, the step

by step approach can be conducted in several ways. The Australian interviewees see this approach as a stepwise involvement of countries. This can be done in several ways, e.g. through the transfer of a national e-health solution or a globally defined e-health solution to other countries. Some German interviewees recommend the same way. Further, some interviewees suggest that they should start in the EU, with developing countries or with little functionality, which can be increased continuously afterwards. The facilitator "get consent" is mentioned here the first time and means, among others, to obtain the political agreement as well as the agreement of the different stakeholders. As emerging "facilitators", "similar medical standards" must be pointed out, because this barrier is stated by interviewees of both countries. This is also known from the transfer focus and will be also very challenging to achieve. On the Australian side, another interesting emerging barrier is "work through WHO/UN to get global acceptance" and on the German side "global standard via WHO/UN". Even if both aspects target different aspects, it comes out that the WHO, the UN or any other comparable organization needs to be involved in the realization of network centric healthcare on a global scale. This is reasonable, because they have the global expertise and they have the trust of the countries. In addition, the WHO or UN might help to fill the gap of an international umbrella organization performing the coordination.

It should be noted that the "facilitators", which require similarities across countries, are surely more challenging to achieve on a global scale than among two countries. The reason is that differences definitely exist among the countries worldwide and therefore these similarities have to be achieved through adaptations, if at all possible. The selection of the right countries is not feasible on a global scale. Consequently, no clear statement can be given for the link between the "barriers" and "facilitators" at the global focus. Further, it should be noted that the global e-health solution must be very basic in order to avoid that the "barriers" listed cause a problem. For example, to have only the name, address and vaccinations of enrollees in electronic from available will reduce the "barriers" and the requirement of specific "facilitators", because they are not sensitive information and they are basically cultural and language neutral. However, this also means that the benefits of such a solution will be small.

By looking on the global focus and considering the domains of network centric healthcare, it can be seen that the presented key results mainly cross the physical and cognitive domains. In this way, it is shown that the realization of network centric healthcare does not purely depend on the technology and e-health solution itself, because the processes and people have for sure a high influence. This situation is already identified at the national and transfer focus.

In the next step, the emerging theme of the global focus is discussed. This emerging theme is "knowledge/exemplars". In this context, the interviews have shown that one of the issues can be "learn from other industries". In detail, the Australian and German interviewees have mentioned several industries, which can serve as knowledge/exemplars for the realization of network centric healthcare. These industries are e.g. airports and airline industry, automotive industry, banking industry, IT manufacturing, military and social networks. For example, the banking industry allows consumers to get money around the globe. Further, the credit cards have the same size globally. In addition, the security needs to be ensured worldwide. Moreover, money can be transferred across the countries. Besides the learning of other industries, it is also conceivable to "learn from research" and to involve the "expertise of people".

Overall, the discussion of the interview findings has shown that the complexity and challenges increase steadily by involving more countries. The national focus involves only one country with several stakeholders, while the transfer focus already include two countries with several stakeholders and even the global focus almost 200 countries with several stakeholders. Furthermore, the transfer focus and global focus have shown several similar barriers and facilitators. However, while at the transfer focus barriers can be avoided or facilitators can already exist by choosing the right countries, such approach is on a global scale not reachable. In addition, the e-health solution and its functions can also influence how challenging the realization of the respective topic is. Moreover, each focus has shown that there exist potential facilitators, which help to overcome the barriers. However, on a global scale, it is not possible to make a clear evaluation, because first of all it must be checked, if some barriers represent knockout barriers, which means conversely that especially in this context, the similarity required to have a facilitator will never exist. Finally, the different focuses have shown that people and processes have a big influence on the respective topic. At the end of the discussion, some selected interview statements are presented, which confirm the increasing challenge by considering nearly 200 countries in contrast to only two countries.

"I think overall as well, I don't know whether there's a specific area to capture this, but a transfer of a solution should have the advantage that it's easier to achieve compared to a global solution. And it might be cheaper than doing a global solution, because you have a solution that already exists and this is where you might need to make a compromise to say wheel this system only does 80% of what I want it to do, but the system is already built, it already exists and I can and I can start tomorrow. To me that's a worthwhile compromise to make." [A-GD-IT1]

"... if you have to talk to 180 countries who everybody has a say "Ja", now we want to have this data field on that card and you have to agree with 180 countries, this is almost impossible." [G-GD-M1]

I think the main difference is still, whether I provide two or two hundred countries with a system, I have a lot more different interests. Maybe I have with two hundred countries compared with two countries more cultural differences, which I must take into consideration. But otherwise... technically it does not matter. [G-H-IT] (Translated from German to English)

"The reason is because the things that you need that the whole system works, they're not going to change from country to country. The only difference that I see is between two countries that can talk to each other and find the contents more easier than for example 150." [G-PUH3-N1]

If two countries work together or hundred, it must always be the same. However, it will be easier to reconcile everything with two countries. [G-MPDE2-DE] (Translated from German to English)

5.2   Triangulation of the Findings

As section 3.2.5 has shown, this study conducts several steps in order to increase the validity of the data and thus of the study. One essential aspect in this context is triangulation, because this study accomplishes data triangulation, methodological triangulation and triangulation in analyzing data. As part of triangulation in analyzing data, chapter 4 has already presented the findings of the case study interviews, the case study questionnaires as well as the ethnographic study. Based on these findings, this section conducts now the triangulation of the findings. In order to perform this, the findings of each analysis are compared with each other and similarities as well as differences are worked out and discussed.

The Australian and German interviewees have mentioned "insufficient enlightenment of people" as one of the most critical barriers for the success of a national e-health solution. At the same time, "enlightenment of people" is the most stated facilitator by interviewees of both countries. On the other side, the questionnaire results have shown that people of both countries tend to be not informed about their e-health solution so far. Further, in both countries, the majority of the informed participants believe that their federal government has not informed them enough about their e-health solution. Consequently, this means that the success of the Australian and German national e-health solutions can be affected negatively.

In addition, interviewees of both countries have mentioned that the "lack of data protection/data security/privacy" is one of the most critical barriers for the success of a national e-health solution. Therefore, it is not surprising that they have frequently mentioned the facilitator "ensure data protection/data security/privacy". The questionnaire results support this issue, because the majority of the informed people in both countries are generally concerned about data protection/data security/privacy. If people do not trust the e-health solution, the success can be at risk.

Furthermore, the interview results have shown that most of the interviewees think that the transferability of e-health solutions across countries is possible. On the other side, the majority of the interviewees, who comment on the feasibility of network centric healthcare respectively a global e-health solution, do not believe that this issue is possible, at least in the next years. Compared to that, 57 % of the informed Australian questionnaire participants and 42 % of the informed German questionnaire participants think that the transferability of e-health solutions across countries is possible. Additionally, based on the overall questionnaire results, there is no clear tendency visible that a global e-health solution is seen to be possible in the future.

Moreover, the interviewees as well as the questionnaire participants see "healthcare systems" and "laws" as major barriers in the context of the transferability of e-health solutions. Further, "existing IT infrastructure respectively technical preconditions" and "culture" are barriers, which are mentioned by interviewees and questionnaire participants; however, with a different level. As already known, the interview results only include the most stated issues. Therefore, before the questionnaire results relating to the barriers are contrasted with the interview results, the questionnaire results provided for "very high influence" and "high influence" are aggregated.

At the end of the triangulation, one aspect needs to be highlighted, because this result is provided by all three data collection methods, i.e. interviews, questionnaire and ethnographic study. This issue is the barrier "different culture". The Australian interviewees as well as the German interviewees have mentioned this barrier in the transferability context, but also at the global focus. Further, the questionnaire participants have seen this barrier in the transferability context. In addition, the ethnographic study component at the two hospitals – the Australian hospital and the German hospital – has proved that cultures differ across countries. In detail, the hospitals have deviating processes and treatment methods differ among the hospitals and countries.

5.3 Further Useful Facilitators

This section presents three further useful facilitators, which can help for the realization of a successful transfer of a national e-health solution. Firstly, the e-health preparedness grid is mentioned. Secondly, actor network theory (ANT) is discussed. Thirdly, the focus is made on change management. It should be noted that there exit many more potential facilitators, which are not part of this study, but which need to be evaluated in further research (see section 6.5).

5.3.1 E-Health Preparedness Grid

In the context of the implementation of a national e-health solution, there exists an e-health preparedness grid in the literature, which helps countries with the evaluation of their e-health readiness (Wickramasinghe et al. 2005; Huang et al. 2010; Wickramasinghe and Schaffer 2010). The following figure 30 illustrates this e-health preparedness grid.
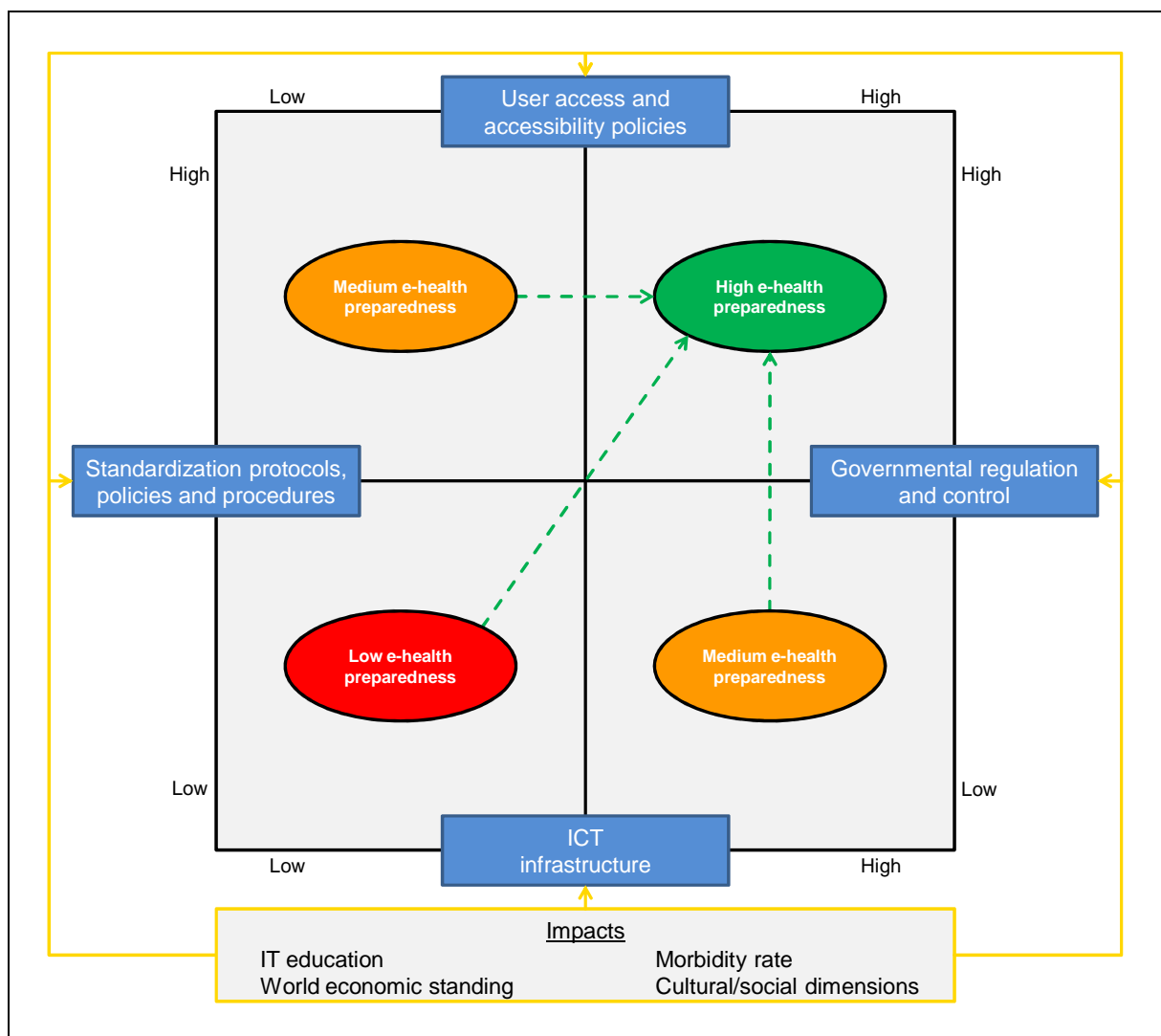
Figure 30: E-health preparedness grid (adapted from Wickramasinghe et al. 2005; Huang et al. 2010)

As figure 30 shows, four impacts need to be considered, which are: IT education; world economic standing; morbidity rate; and cultural/social dimensions (Wickramasinghe et al. 2005; Huang et al. 2010; Wickramasinghe and Schaffer 2010). In addition, the other aspects to consider are the four prerequisites, which were already presented in section 2.2.1 and which are: ICT infrastructure; standardization protocols, policies and procedures; user access and accessibility policies; and governmental regulation and control (Wickramasinghe et al. 2005; Huang et al. 2010; Wickramasinghe and Schaffer 2010). All these issues are arranged around four quadrants (Wickramasinghe et al. 2005; Huang et al. 2010; Wickramasinghe and Schaffer 2010). One extreme quadrant represents the "low e-health preparedness", because in this field, the four prerequisites are "low" represented (Wickramasinghe et al. 2005; Huang et al. 2010; Wickramasinghe and Schaffer 2010). The other extreme quadrant represents the "high e-health preparedness", as here the fulfillment of the four prerequisites is already "high" (Wickramasinghe et al. 2005; Huang et al. 2010; Wickramasinghe and Schaffer 2010). Between the two extreme quadrants, there exist two quadrants, where "medium e-health preparedness" is common, which means that the current constellation of the four prerequisites requires more work, because only parts of the prerequisites are "high", while others are still "low" (Wickramasinghe et al. 2005; Huang et al. 2010; Wickramasinghe and Schaffer 2010).

Based on the e-health preparedness grid, countries can check whether they are ready for a national e-health solution or not (Wickramasinghe et al. 2005; Huang et al. 2010; Wickramasinghe and Schaffer 2010). If they are not ready yet, they see at least the further way, they have to follow (Wickramasinghe et al. 2005; Huang et al. 2010; Wickramasinghe and Schaffer 2010). This all applies for the implementation of an own development likewise a transfer of a national e-health solution to another country, as in both cases, the country must have the four prerequisites appropriately fulfilled (Wickramasinghe et al. 2005; Huang et al. 2010; Wickramasinghe and Schaffer 2010). Though, in case of a transfer, the receiving country has the advantage that it can orientate on the transferring country, which can make the whole process easier. Further, it is recommendable that the receiving country does not only concentrate on the fulfillment of the four prerequisites, rather they should create a "similar stage" of e-health preparedness as common in the transferring country.

5.3.2 Actor Network Theory

This section focuses on actor network theory (ANT). Two key researchers in this field of study are Callon and Latour (Callon 1986; Latour 2005). ANT allows a detailed lens of analysis for cases involving people as well as technology and is already proven in the context

of healthcare and e-health by several studies (Callon 1986; Latour 2005; Wickramasinghe et al. 2007; Zwicker et al. 2012a; Muhammad et al. 2013a; Muhammad et al. 2013b).

ANT includes three stages: inscription, translation and framing (Callon 1986; Latour 2005; Wickramasinghe et al. 2007; Muhammad et al. 2013a). However, given the transferability context of this study, where e-health stakeholders have to negotiate and work together across borders, while an e-health solution influences the setting, the focus is on translation in the further course. In detail, Callon divides translation in four sub-stages, namely problematization, interessement, enrollment and mobilization (Callon 1986). The following figure 31 illustrates this circumstance.

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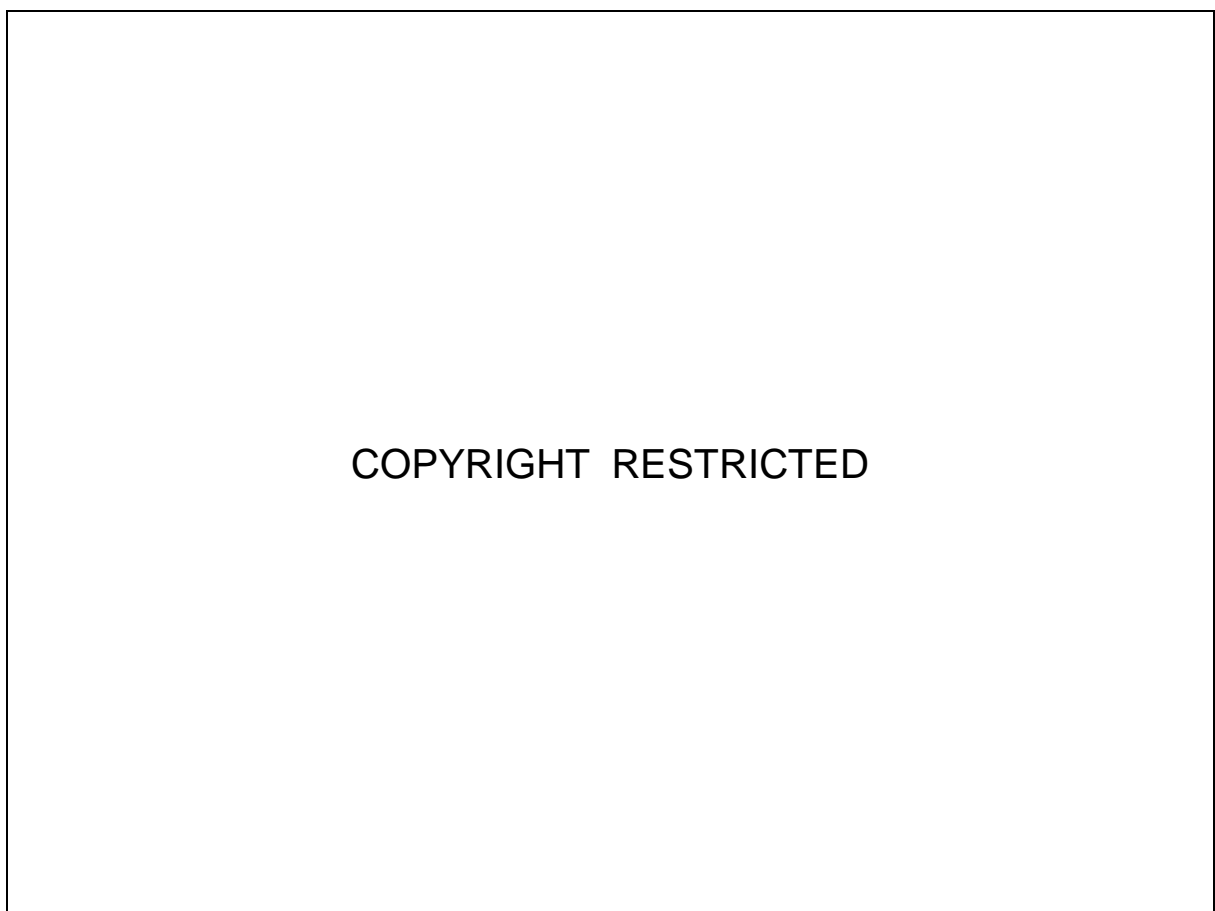
Figure 31: Appling the translation stage of ANT for this study (adapted from Muhammad et al. 2013b)
[Because countries and their healthcare systems are different, the different layers have a different color.]

During the problematization stage, the problem is identified and formulated, but also the different actor groups including group leaders are identified (Callon 1986; Wickramasinghe et al. 2007; Muhammad et al. 2013b). During the interessement stage, the group leaders negotiate with their actors and define clear roles, overall with the goal to awaken the interest of the actors (Callon 1986; Wickramasinghe et al. 2007; Muhammad et al. 2013b). During the

enrollment stage, the focal point lies on the acceptance through the diverse actors (Callon 1986; Wickramasinghe et al. 2007; Muhammad et al. 2013b). Finally, the mobilization stage deals with the continuous management and maintenance of the network, including the check of the correct representation of the actors through their group leaders (Callon 1986; Wickramasinghe et al. 2007; Muhammad et al. 2013b).

Based on the transferability focus of the study, it is important that countries consider ANT and especially the translation stage. In particular, the federal governments and the head organizations have a big role to fulfill. As the study results have already shown, the "environment" is the emerging theme of the transfer focus. Accordingly, an essential aspect of the environment is clearly the actor network.

5.3.3 Change Management

A transfer of a national e-health solution from one country to another country leads to a fundamental change in the receiving country. This change does not affect only some e-health stakeholders, because depending on the respective e-health solution, normally all e-health stakeholders including doctors, hospitals and health insurance companies are impacted. Further, such a transfer changes the way, how people, processes and technology interact. For example, doctors have to prescribe medicine electronically, have to document their treatment electronically, or new computers and software might be necessary. Therefore, principles of change management are necessary.

In this context, one well known process model is Kotter's eight step plan for changing an organization (Kotter 1995). These steps are illustrated in detail in figure 32. These steps can be used by hospitals, health insurance companies, etc., in order to prepare themselves including their staff for the new e-health solution environment. However, it is important to note that the federal government can also use this process model for the implementation of the transferred e-health solution on the country level. In this way, they have to create the vision in their whole country and work with the other e-health stakeholders together.

In addition, Wickramasinghe and Schaffer have mentioned that organizations, affected by a change, need to be resilience (Wickramasinghe and Schaffer 2010). Furthermore, they have identified seven issues positively influencing this resilience, which are: powerful commitment; obvious processes; proper detection of the nature of the specific change; high synergy level; the definition of the roles must be precise; a simplified culture; and minor resistance (Wickramasinghe and Schaffer 2010). All these aspects as well as a powerful

leadership are important for the realization of a successful change management (Wickramasinghe and Schaffer 2010). Moreover, it is conceivable that also these findings can be applied on the national level and can help the federal government in the exercise of the respective change, caused through the transfer of a national e-health solution from one country to the other country.
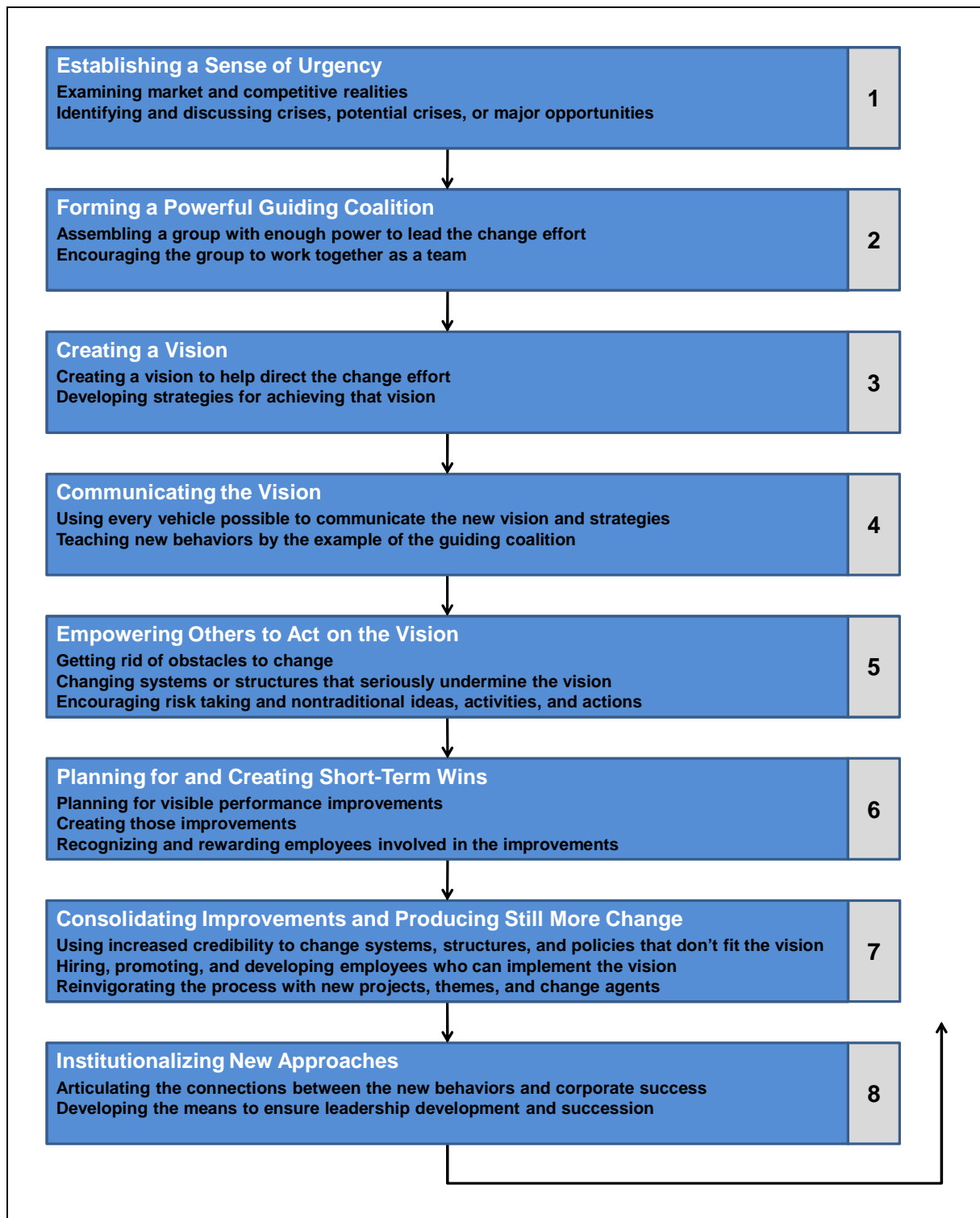
Establishing a Sense of Urgency Examining market and competitive realities Identifying and discussing crises, potential crises, or major opportunities	1
Forming a Powerful Guiding Coalition Assembling a group with enough power to lead the change effort Encouraging the group to work together as a team	2
Creating a Vision Creating a vision to help direct the change effort Developing strategies for achieving that vision	3
Communicating the Vision Using every vehicle possible to communicate the new vision and strategies Teaching new behaviors by the example of the guiding coalition	4
Empowering Others to Act on the Vision Getting rid of obstacles to change Changing systems or structures that seriously undermine the vision Encouraging risk taking and nontraditional ideas, activities, and actions	5
Planning for and Creating Short-Term Wins Planning for visible performance improvements Creating those improvements Recognizing and rewarding employees involved in the improvements	6
Consolidating Improvements and Producing Still More Change Using increased credibility to change systems, structures, and policies that don't fit the vision Hiring, promoting, and developing employees who can implement the vision Reinvigorating the process with new projects, themes, and change agents	7
Institutionalizing New Approaches Articulating the connections between the new behaviors and corporate success Developing the means to ensure leadership development and succession	8

Figure 32: Eight steps to transforming an organization (adapted from Kotter 1995)

5.4 Key Lessons Learned

By conducting this study, several lessons learned could be identified. The following table 22 lists the six key lessons learned.

Lesson 1	Generally, the questions should be more split into more specific questions. For example, the researcher has asked for key factors and barriers within one question. Based on this issue, it cannot be guaranteed that the given answer can be classified directly. Therefore, in several cases the separation requests a detailed analysis. However, it is important to learn from this issue and consider this issue during the development of an interview protocol and/or questionnaire in the future.
Lesson 2	Another lesson learned is to define the questions more detailed in order to avoid misunderstandings. For example, "your e-health solution" has led sometimes to misinterpretation through the hospital staff, as the term "national" was not provided. Further, it is also important to provide all necessary definitions like "e-health solution" or "transferability" very explicitly in the plain language statement.
Lesson 3	Include more flexibility in the interview protocol necessary as looking at two different countries, namely Australia and Germany.
Lesson 4	Because of different accents, interviews take more time. Therefore, budget for this in future.
Lesson 5	Based on the situation that a lot of participants are not informed about the e-health solution of their country, a lesson learned is that a questionnaire, which is focused on a specific topic, should also include one or more general knowledge questions, which ask for example: "Who is the president/prime minister of your country?", "Who won the rugby championship 2012?", etc. This serves to realize, if participants are not informed about e-health specifically or if they are also generally unaware of or disinterested in news/general knowledge.
Lesson 6	The questionnaire used in this study includes a logical flow. There are several main questions. Depending on the answer given by the participant, the participant has to answer follow-up questions. However, the design of the questionnaire only considers follow-up questions, if the participant was able to answer the corresponding main question in a positive way. In this context, the lesson learned is that the questionnaire should also incorporate follow-up questions for the situation that the participant cannot answer the main question(s), because it helps to understand, why people are not able to answer the main question(s), why they disagree, etc. These answers can lead to a richer discussion and a more detailed research. Therefore, this issue should be considered during the development of the questionnaire in further studies.

Table 22: Key lessons learned through this study
[Lesson 1 and lesson 2 are general issues. Lesson 3 and lesson 4 relate to the interviews specifically, while lesson 5 and lesson 6 refer to the questionnaire.]

5.5 Summary

Firstly, this chapter has discussed the interview findings gained through the case study in Australia and the case study in Germany. In detail, the findings of the national focus, the transfer focus and the global focus were discussed. Generally, the same procedure was used for each focus. In the first step, an overall statement was given, what the Australian and German interviewees think about the respective topic. Relating to the national focus, the Australian interviewees were overall cautious in the statements or unable to give a comment, when they were asked, what they think about their national e-health solution, while the German interviewees see their national e-health solution overall more positive. With respect to the transfer focus, the majority of the interviewees think that the transferability of e-health solutions across countries is possible. Concerning the global focus, the majority of the interviewees think positive about the idea of a global e-health solution respectively network centric healthcare on a global scale; however, at the same time, most of the interviewees from each country, who commented on the feasibility, believe that the realization of network centric healthcare would be not possible, at least in the next years. In the second step, the key findings were discussed. In the third step, the emerging themes were evaluated and details were presented. Especially for the transfer focus, a further discussion was given in order to answer which e-health functions, ideas and approaches can be transferred across countries. It has been shown that generally all e-health functions, ideas and approaches can be transferred across countries and/or different healthcare actors, but the identified "key factors", "barriers" and "facilitators" influence, how easy or challenging it is to transfer. In addition, the results of the SWOT analysis as well as the advantages and disadvantages for the different stakeholders were presented. In order to support the discussion of the findings, direct quotes of the interviews were applied.

Secondly, this chapter has conducted the triangulation of the findings achieved through the case study interviews, the case study questionnaires as well as the ethnographic study. One major aspect was about the enlightenment of people, because it is the most stated facilitator by interviewees of both countries, but the questionnaire results have shown that people of both countries tend to be not informed about their e-health solution so far. Another key topic of the triangulation was culture, because this issue has occurred at all three data collection methods.

Thirdly, three further useful facilitators were presented and discussed, which can help for the realization of a successful transfer of a national e-health solution. These three facilitators are the e-health preparedness grid, actor network theory and change management.

Finally, the six key lessons learned from this study were stated. Two lessons learned target general issues, two key lessons learned relate to the interviews and two lessons learned refer to the questionnaire.

CHAPTER 6

6.   Conclusions

Firstly, this chapter answers the research question and its supporting questions. Secondly, this chapter highlights the contributions to theory and gives recommendations for theory. Thirdly, the contributions to practice and recommendations for practice are presented. Fourthly, the key limitations of this study are described. Fifthly, based on the results an outlook for future studies is given. Finally, the concluding remarks are stated.

6.1   Answer the Research Question

The research question "How can different e-health solutions be transferred to other countries?" is answered by answering the three sub-questions. The first sub-question "Which are the key factors and barriers that influence the transferability of e-health solutions?" is answered as several key factors and barriers could be identified through this research. As key factors, among others, "scope of transfer" and "win-win situation for both countries" could be detected. Examples of the barriers identified are "different healthcare systems", "different laws" and "different cultures". In addition, several facilitators like e.g. "similar healthcare systems", "similar laws" and "similar cultures" could be identified.

The second sub-question "Is the doctrine of network centric healthcare only convertible nationally or is it also realizable globally?" is as well answered during this research. The findings show that the realization of network centric healthcare on a global scale respectively a global e-health solution is very challenging. The reason is that several key factors, barriers and facilitators could be detected in this context. To overcome the barriers on a global scale is very difficult, especially because such a project involves almost 200 countries, each with multiple stakeholders.

The third sub-question "Which e-health functions, ideas and approaches can be transferred across countries and/or different healthcare actors?" is also answered by this research. In general, all e-health functions, ideas and approaches can be transferred across countries and/or different healthcare actors. However, the identified key factors, barriers and facilitators influence, how easy or challenging a transfer is.

Overall, this study has shown that even the success of a national e-health solution is very challenging. It is important that the e-health stakeholders are involved in the development and implementation process. Additionally, it is indicated that an insufficient enlightenment of

people can be a barrier for the success and therefore needs to be ensured. Furthermore, this study has shown that a step by step implementation of a national e-health solution can help for the success. However, this also requires that the national e-health solution is appropriately designed. For instance, every e-health function should be an own module. Consequently, countries like Australia and Germany have to consider these aspects, because these are important issues for the success of a national e-health solution. And to get a successful national e-health solution is essential, because it is the prerequisite for the transfer of a national e-health solution from one country to other countries, which in turn can also lead to a global e-health solution in the future. In this way, as well the costly and time consuming national developments and platform centric thinking can be avoided in the future. Though, especially the design of the chosen national e-health solution is important for the transfer, because the possibility of "local adaptations of the e-health solution" is one of the identified facilitators in the transfer context. Further, based on the study results, it can be also very helpful for instance, if a national e-health solution is selected, whose design allows changing the language or which is based on a common language like English. Additionally, it is also useful to separate the e-health functions depending on medical terminology. Moreover, if the design includes too many e-health functions, in particular the barriers could be a problem.

This study has also illustrated that the challenge increases with the complexity, i.e. while a national e-health solution only involves one country and its stakeholders, the transfer of a national e-health solution already includes two countries, each with multiple stakeholders. A global e-health solution actually means nearly 200 countries, each with several stakeholders. It makes also a difference, if the e-health solution encompasses only a few e-health functions or multiple e-health functions. Even if several barriers and facilitators identified are similar at the transfer focus and global focus, it is for sure more challenging on a global scale, because to get similarity and consent among the countries worldwide is a difficult endeavor. Further, at the transfer focus, there is the chance for choosing the right countries, i.e. specific barriers do not exist from the start and facilitators are already present, which is not given on a global scale.

As a result, this means that the transferability of e-health solutions to other countries is possible, but depending on the chosen countries and the selected national e-health solution, can be a complex business. Therefore, it is recommended to start with "similar" countries and to choose an appropriately designed national e-health solution. If no adequate designed national e-health solution could be detected, it is prudent – also in regards to a global e-health solution – to change an existing national e-health solution first, before the transfer is

conducted. Further, the study has shown that the key factors, barriers and facilitators of each focus cross the different domains of network centric healthcare operations, which means that people and processes also have a substantial influence on the transferability of e-health solutions to other countries. However, the results also underline that if all these identified challenges can be addressed, the transfer works. By recalling the whole study and its findings, following unexpected/surprising aspects could be identified:

- The implementation of the Australian and German national e-health solutions seems to be unprofessional. If this is the case at the national level, it can be conceivable how challenging it is to realize and manage a transfer or even a global e-health solution.

- The interviews have provided only a few emerging findings.

- The interview findings for the transfer focus and the global focus have provided several similar results. This shows that the challenge lies not on new aspects rather than on the increased amount of countries, people, etc.

- Questionnaire participants are less informed about their national e-health solution. Especially the lack of knowledge and the insufficient involvement of people are astonishing. The federal government and the responsible institutions/organizations should know that their behavior is risky for the success of their national e-health solution.

Based on the findings following propositions could be identified:

- If you follow the findings of this study including the key factors, barriers, facilitators, emerging themes and perspectives, the transfer of a national e-health solution from one country to another country definitely works, whereas network centric healthcare is still challenging to achieve globally.

- If you conduct the interviews, the questionnaire and the ethnographic study in other countries, it will lead mostly to the same results.

- If the general public and the other e-health stakeholders are more involved in the development and implementation process of an e-health solution, a national e-health solution will have more success.

- If the general public and the other e-health stakeholders are better informed about the e-health solution, a national e-health solution will have more success.

6.2 Contributions to Theory and Recommendations for Theory

Overall, the contribution to theory is that this research answers the research question, "How can different e-health solutions be transferred to other countries". In detail, the contributions to theory are:

- Research answers that national e-health solutions can be transferred, but must also include principles like actor network theory and change management.

- Research answers how e-health solutions can be transferred: by identifying various key factors and barriers, which can influence the transfer; by identifying several facilitators; and by identifying which perspectives must be taken into consideration to guarantee a successful realization.

- Research contributes to the literature pertaining to NCHO.

The recommendations for theory are:

- Be aware of the identified key factors, barriers, facilitators as well as the perspectives, which must be taken into consideration, because this findings help for a successful realization of a transfer.

- Expand network centric healthcare operations to include facilitators like actor network theory and change management.

In the context of the presented contributions to theory and recommendations for theory, it is also essential to follow the suggestions of Venkatesh et al., which means to evaluate this mixed research adopted for its appropriateness and development of meta-inferences, but also to focus on the assessment of the quality of the respective meta-inferences (Venkatesh et al. 2013):

- Appropriateness to use the mixed research approach: section 3.1.4 has already explained why a mixed research approach was chosen for this exploratory research. Given the situation that the study's research question targets a new evolving area, the mixed research approach allows to get deep and rich insights by involving different stakeholders and by collecting qualitative and quantitative data with diverse data collection methods. These different data collection methods allow further the triangulation in analyzing data and in this way the triangulation of the findings.

- Development of meta-inferences: after the presentation of the findings of the different data collection methods in chapter 4, section 5.2 has conducted the triangulation of the findings. This procedure enables to compare the findings of each analysis with each other and to show and discuss the similarities as well as differences. The results are meta-inferences, which give more detailed insights and create a better (theoretical) understanding of the transferability of e-health solutions and network centric healthcare.

- Assessment of the quality of the respective meta-inferences: section 3.2.5 has presented several steps to increase the validity of the data. Due to these steps, the meta-inferences could be developed. If these meta-inferences can be transferred to another context needs to be tested in further research. However, these meta-inferences have shown that some findings of the qualitative component confirm the findings of the quantitative component and that the diverse target groups of the data collection methods have similar and divergent perceptions. In addition, it was possible to include findings of each data collection method in the triangulation of the findings, which supports the quality of the resulting meta-inferences.

6.3 Contributions to Practice and Recommendations for Practice

In detail, the contributions to practice are:

- Research provides recommendations that can support governments in their e-health decisions as well as how it is possible to transfer national e-health solutions (mezzo and macro).

- Research provides evidence that network centric healthcare, demonstrated at a global level, is very challenging to achieve (micro, mezzo and macro).

The recommendations for practice are:

- Choose a successful national e-health solution and then examine how to transfer this e-health solution to the other country (macro).

- To make a transfer successful, it is necessary to consider, among others, the identified key factors, barriers, facilitators and perspectives (micro, mezzo and macro).

6.4   Key Limitations

There are eight key limitations obvious in this study. The following table 23 mentions these key limitations.

Limitation 1	There is the problem of "natural bias" of the researcher as is common in qualitative studies. The reason is that the dissertation is in a large part based on the German e-health solution. Therefore, there is always the risk that the researcher loses his objectiveness and makes his decisions not based on facts as rather on his "German eyes". To address this multiple sources of supporting evidence were used.
Limitation 2	Another limitation of this study is that while conducting this research and data collection, the Australian national e-health solution as well as the German national e-health solution were not available in their full amount. Further, especially the implementation plan of the German national e-health solution changed over the time.
Limitation 3	Because this study focuses on a new evolving area, the literature is not as deep as in more well established domains. However, this is also further evidence of the importance and need for this study, as it is "ground breaking research".
Limitation 4	Given the situation that the data collection was conducted in two countries, namely Australia and Germany, and within the countries with several different e-health stakeholders, it was very challenging to involve all the stakeholders in the same amount within the country as well as across the two countries. It was also very challenging to find across the two countries for all stakeholders compareable interviewees, who have e.g. exactly the same position, background and/or practical experience.The researcher has done everything to reduce the differences to a minimum.
Limitation 5	Not each interviewee has answered each question of the interview protocol.
Limitation 6	During the transcription of the audio files and notes, not all details were audible and readable.
Limitation 7	While conducting this study, at several stages translations from English to German and reverse were necessary. This brings along the risk of translation mistakes. Therefore, the translation of the interview protocol and questionnaire from English to German were checked by an appropriate expert of the languages and the topic area. Further, as some interviews were conducted in German, some translated samples of the findings were also checked by this person.
Limitation 8	Because of visa issues, the researcher was not able to work at an hospital in Australia as done in Germany.

Table 23: Key limitations of this study

6.5 Future Studies

For future studies, several recommendations can be given. Firstly, based on the developed conceptual framework and the study results, it is important in a next step to develop a new interview protocol and questionnaire. In this way, it is possible to build up on the generated knowledge of this study and evaluate its results in a further in depth analysis. Thereby, it is also recommended to involve new countries in the future studies.

Secondly, in the context of the transferability of e-health solutions and the identified barriers, it is important to develop a matrix in future studies. This matrix should be designed comparable to the e-health preparedness grid and should include on each side a specific aspect, like "languages" and "cultures" and the separation should be made between "different" and "similar" according to "barriers" and "facilitators". In a next step, country pairs should be assigned to the specific fields. For example, the country pair "China/Germany" has completely different languages and different cultures. In the course of this, the barriers among the countries should be checked if they can be overcome or if they represent knockout barriers in that particular country pair case.

Thirdly, in the context of the transferability of e-health solutions, it is also important to check further well-established theories/principles for their potential to serve as facilitators. Examples could be knowledge management, process management, project management, re-engineering, lean thinking, six sigma and lean six sigma.

Finally, if one country worldwide wants to have a national e-health solution in the future, it is important to use that chance and transfer a national e-health solution from one country to this particular country. In this way, the findings of this study can be checked in real life.

6.6 Concluding Remarks

Due to the challenges and problems countries are confronted with, this study has analyzed the transferability of e-health solutions to other countries. In order to answer the research question, a methodology based on a mixed research approach was chosen. In detail, two exemplar case studies, i.e. one in Australia and one in Germany, were conducted. The case study in Australia and the case study in Germany encompassed unstructured interviews with e-health stakeholders and a questionnaire based on closed-ended questions for the general public. Further, in both countries, an ethnographic study was conducted at a hospital.

As has been presented in this study, the findings show that the transferability of e-health solutions to other countries is possible. However, there exist, among others, several "key factors", "barriers" and "facilitators" influencing the transferability of e-health solutions. Given that healthcare is an important area, because human life depends on healthcare, and because e-health will continue to play a key role, this thesis, as discussed, has several contributions to and recommendations for theory and practice.

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Appendix 1:

Interview Protocol

<u>Qualitative Interview Questions</u>

<u>General/Demography/Background of the Interviewee</u>

1.1 What is your gender?

_____

1.2 What are your post code, city and country?

_____

_____

1.3 What is your nationality?

_____

_____

1.4 What is your affiliation?

_____

_____

1.5 What is your area of work/position?

_____

_____

1.6 Is your age between 18 – 30, 31 – 50, 50 – 67 or 67 and older?

_____

1.7 In which kind of health insurance program are you enrolled? (two answers allowed)

_____

_____

<u>E-Health Solution</u>

2.1 What do you think about the e-health solution in your country?

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_____

Why? Reasons?

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What do you think about following e-health functions?

Germany		Australia	
Storage of enrollee data		Personally controlled electronic health record (PCEHR)	
European Health Insurance Card (EHIC)		e-Diagnostic Imaging	
Electronic prescription (e-prescription)		e-Pathology	
Documentation of medicine		e-Discharge Summaries	
Emergency data record		e-Referrals	
Electronic health record (EHR)		e-Medication Management	
Online: Possibility to check and update enrollee data		Electronic prescription (e-prescription)	
Communication between medical practitioners			
Electronic case file			

If the utilization would be voluntary, which functions would you recommend to use/to implement within your e-health solution?

_____

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_____

_____

Why? Reasons?

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2.2 Which key factors/barriers/problems do you think influence the success of your e-health solution?

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Why? Reasons?

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_____

Any solutions or suggestions?

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2.3 Does the implementation of your e-health solution go according to the original implementation plan (considering timeframe and e-health functions)?

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If no, why? Reasons?

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If no, what are the changes based on the original implementation plan?

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_____

What do you think about these changes?

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Why? Reasons?

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What do you think are the reasons/problems that these changes could happen?

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What do you think could they make better?

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Why? Reasons?

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Which suggestions would you give other countries with the implementation of an e-health solution?

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_____
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Why? Reasons?

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2.4 Does your government do enough for enlightenment of people about your e-health solution?

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_____
_____
_____

Why? Reasons?

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If no, any solutions or suggestions?

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2.5 Do you know any problems, which occurred within the test stage of your e-health solution?

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What are the lessons learned from these problems?

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2.6 Do you think that there exist special problems for the rural areas respective your e-health solution?

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If yes, which problems?

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Why? Reasons?

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Any solutions or suggestions? (also technical solutions)

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Data Protection/Data Security/Privacy

3.1 Do you think that there exist barriers/problems with your e-health solution respective data protection, data security and/or privacy?

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_____
_____
_____

If yes, which problems?

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Why? Reasons?

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If yes, any solutions or suggestions? (also technical solutions)

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If yes, do you think that these problems are crucial for the success of your e-health solution?

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Why? Reasons?

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If yes, do you think that enough is done to avoid these problems?

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Federal Government and E-Health Institutions/Organizations

4.1 Which of both do you think has the most influence on the success of your e-health solution, the federal government or the e-health institutions/organizations?

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Why? Reasons?

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4.2 Do you think that the federal government and/or the e-health institutions/organizations have too much influence on the success of your e-health solution?

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If yes, who?

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Why? Reasons?

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If yes, any solutions or suggestions?

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4.3 How would you describe the impact of the federal government and the e-health institutions/organizations on the success of your e-health solution?

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Why? Reasons?

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4.4 Do you think that the federal government and the e-health institutions/organizations have involved/involve the other e-health stakeholders enough in the development and implementation process of your e-health solution?

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Why? Reasons?

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If no, any solutions or suggestions for the current process?

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If no, what are the lessons learned for the future?

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Network Centric Healthcare (One Global E-Health Solution)

5.1 What do you think about the idea of a global e-health solution (network centric healthcare)?

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Why? Reasons?

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5.2 Which key factors/barriers/problems do you think influence the realization of network centric healthcare?

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Why? Reasons?

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Any solutions or suggestions?

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5.3 What are the strengths, weaknesses, opportunities and threats of a global e-health solution?

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Why? Reasons?

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5.4 Which advantages and disadvantages do you see for the different e-health stakeholders, when network centric healthcare would be realized?

Federal government

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_____
_____
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Why? Reasons?

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_____

E-health institutions/organizations

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Why? Reasons?

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Hospitals

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Why? Reasons?

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Enrollees

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Why? Reasons?

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Pharmacists

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Why? Reasons?

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Physicians/dentists

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Why? Reasons?

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Health insurance companies

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Why? Reasons?

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Suppliers for e-health material

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Why? Reasons?

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5.5 Do you think that we can learn from other industries in order to realize a global e-health solution?

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If yes, which industry? (e.g. the banking industry)

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Why? Reasons?

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Which lessons learned from this industry can be adopted to help network centric healthcare with its realization and acceptance?

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Why? Reasons?

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Other solutions or suggestions, which can help for the realization and acceptance of network centric healthcare?

_____
_____
_____
_____

Why? Reasons?

_____
_____
_____
_____

Transferability of E-Health Solutions

6.1 Do you think that the transferability of e-health solutions across countries is possible?

_____

_____

_____

_____

Why? Reasons?

_____

_____

_____

_____

6.2 Which key factors/barriers do you think influence the transferability of e-health solutions?

_____

_____

_____

_____

Why? Reasons?

_____

_____

_____

_____

6.3 Which requirements do you think are important for the transferability of e-health solutions?

<u>Organizational requirements</u>

_____

_____

_____

_____

Why? Reasons?

_____

_____

_____

_____

<u>Structural requirements</u>

_____
_____
_____
_____

Why? Reasons?

_____
_____
_____
_____

<u>Technical requirements (e.g. telematics infrastructure)</u>

_____
_____
_____
_____

Why? Reasons?

_____
_____
_____
_____

<u>Regulatory requirements</u>

_____
_____
_____
_____

Why? Reasons?

_____
_____
_____
_____

<u>Other requirements</u>

_____
_____
_____
_____

Why? Reasons?

_____
_____
_____
_____

Do you think that these requirements are also applicable for the realization of a global e-health solution?

_____
_____
_____
_____

Why? Reasons?

_____
_____
_____
_____

If yes, do you see any deviations?

_____
_____
_____
_____

If yes, which deviations do you see?

_____
_____
_____
_____

Why? Reasons?

_____
_____
_____
_____

6.4 Which e-health functions, ideas and approaches do you think can be transferred across countries?

_____
_____
_____
_____

Why? Reasons?

_____
_____
_____
_____

6.5 What are the strengths, weaknesses, opportunities and threats after an e-health solution has been transferred from one country to another country?

_____
_____
_____
_____

Why? Reasons?

_____
_____
_____
_____

6.6 Which advantages and disadvantages do you see for the different e-health stakeholders after an e-health solution has been transferred from one country to another country?

<u>Federal government</u>

_____
_____
_____
_____

Why? Reasons?

_____
_____
_____
_____

<u>E-health institutions/organizations</u>

_____
_____
_____
_____

Why? Reasons?

_____
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_____

<u>Hospitals</u>

_____
_____
_____
_____

Why? Reasons?

_____
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_____
_____

<u>Enrollees</u>

_____
_____
_____
_____

Why? Reasons?

_____
_____
_____
_____

<u>Pharmacists</u>

_____
_____
_____
_____

Why? Reasons?

_____
_____
_____
_____

Physicians/dentists

_____
_____
_____
_____

Why? Reasons?

_____
_____
_____
_____

Health insurance companies

_____
_____
_____
_____

Why? Reasons?

_____
_____
_____
_____

Suppliers for e-health material

_____
_____
_____
_____

Why? Reasons?

_____
_____
_____
_____

6.7 Which e-health stakeholder do you think has the biggest impact on the transferability of e-health solutions?

_____
_____
_____
_____

Why? Reasons?

_____
_____
_____
_____

Working Environment

7.1 What impact will your e-health solution have on your working environment?

_____
_____
_____
_____

Why? Reasons?

_____
_____
_____
_____

Which adaptations and/or changes within your e-health solution will be important for your working environment?

_____
_____
_____
_____

Why? Reasons?

_____
_____
_____
_____

Which further changes do you expect in your working environment in the future as a result of your e-health solution?

_____
_____
_____
_____

Why? Reasons?

_____
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Further Comments

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Appendix 2:

Questionnaire

Quantitative Approach: Questionnaire

General/Demographic Questions

Gender

Male ☐

Female ☐

Age group

18 – 30 ☐

31 – 50 ☐

50 – 67 ☐

67 and older ☐

Health insurance program (two answers are allowed)

Public health insurance program ☐

Private health insurance program ☐

Supplementary private health insurance program ☐

Specific Questions

1.) Are you informed about the electronic health (e-health) solution of your country? If "Yes", please go to question 2. If "No", then please stop here.

Yes ☐

No ☐

2.) Do you think that the federal government informed you enough about your e-health solution?

Yes ☐

No ☐

I do not know ☐

I do not care ☐

3.) Are you working in the healthcare sector? If "Yes", please go to question 4. If "No", then please move to question 6.

Yes ☐

No ☐

4.) What is your affiliation in the healthcare sector?

Hospital ☐

Medical practice for dentists ☐

Medical practice for physicians ☐

Health insurance company ☐

Pharmacy ☐

E-health institution/organization ☐

Supplier for e-health material ☐

Consulting company ☐

Other affiliation ☐

5.) What is your area of work/position in the healthcare sector?

Administrator ☐

Physician ☐

Dentist ☐

Technician ☐

Pharmacist ☐

Consultant ☐

Employee ☐

Other area of work/position ☐

6.) Do you like the e-health solution of your country?

Yes ☐

No ☐

I do not know ☐

I do not care ☐

7.) Would you like to have influence on the development of your e-health solution?

    Yes   ☐

    No   ☐

    I do not know   ☐

    I do not care   ☐

8.) Are you generally concerned about data protection/data security/privacy regarding your e-health solution? If "Yes", please go to question 9. If "No" or "I do not know" or "I do not care", please move to question 10.

    Yes   ☐

    No   ☐

    I do not know   ☐

    I do not care   ☐

9.) Please evaluate following possible situations/circumstances/feelings based on your level of concern regarding data protection/data security/privacy.

	Very high concern	High concern	Medium concern	Low concern	Very low concern	No concern	I do not know	I do not care
Personal health data theft: hacker attack	☐	☐	☐	☐	☐	☐	☐	☐
Manipulation of health data: hacker attack	☐	☐	☐	☐	☐	☐	☐	☐
Misuse of your health data	☐	☐	☐	☐	☐	☐	☐	☐
Transparent patient	☐	☐	☐	☐	☐	☐	☐	☐
Continuous uneasy/bad feeling during your daily life	☐	☐	☐	☐	☐	☐	☐	☐

10.)If you could decide, which of the following e-health functions would you like to use?

- Storage of enrollee data ☐
- European Health Insurance Card ☐
- e-prescription ☐
- Documentation of medicine ☐
- Emergency data record ☐
- Electronic health record ☐
- Online: possibility to check and update enrollee data ☐
- Communication between medical practitioners ☐
- Electronic case file ☐
- Personally controlled electronic health record ☐
- e-Diagnostic Imaging: aims to enable a nationally-endorsed, consistent and secure electronic exchange of diagnostic images across the healthcare sector ☐
- e-Pathology: aims to enable a nationally-endorsed, consistent and secure exchange of pathology information across the healthcare sector, using an agreed approach and standardized format ☐
- e-Discharge Summaries: enable the electronic exchange of comprehensive and accurate patient reports between hospitals and primary healthcare sectors ☐
- e-Referrals: facilitate the seamless exchange of significant patient information from one treating healthcare provider to another ☐
- e-Medication Management: improved use of medicines and a reduction of the number of adverse medication events ☐

11.)Would you like the idea to have access to your health information when you are abroad?

Yes ☐

No ☐

I do not know ☐

I do not care ☐

12.)Do you think that the transferability of e-health solutions across countries is possible? If "Yes", please go to question 13. If "No" or "I do not know" or "I do not care", please move to question 19.

Yes ☐

No ☐

I do not know ☐

I do not care ☐

13.)Please evaluate the following possible factors/barriers based on your opinion about their influence regarding the transferability of e-health solutions.

	Very high influence	High influence	Medium influence	Low influence	Very low influence	No influence	I do not know	I do not care
Costs	☐	☐	☐	☐	☐	☐	☐	☐
Existing telematics infrastructure (IT infrastructure)	☐	☐	☐	☐	☐	☐	☐	☐
Federal government/ laws	☐	☐	☐	☐	☐	☐	☐	☐
E-health institutions/ organizations	☐	☐	☐	☐	☐	☐	☐	☐
Healthcare systems of the countries (same/similar/ different)	☐	☐	☐	☐	☐	☐	☐	☐
Planning mistakes	☐	☐	☐	☐	☐	☐	☐	☐
Time	☐	☐	☐	☐	☐	☐	☐	☐
Culture	☐	☐	☐	☐	☐	☐	☐	☐

14.) Do you see any strengths/opportunities after an e-health solution has been transferred from one country to another country? If "Yes", please go to question 15. If "No" or "I do not know" or "I do not care", please move to question 16.

Yes ☐

No ☐

I do not know ☐

I do not care ☐

15.) Which strengths/opportunities do you see after an e-health solution has been transferred from one country to another country? (several answers possible)

- Lower costs than an own development ☐

- Cooperation for further e-health solution development between these countries is possible ☐

- E-health can be used earlier compared with the development of an own e-health solution ☐

- Higher quality of care ☐

- Health information exchange between these countries is possible ☐

- Several weaknesses/threats regarding data protection/data security/privacy are already known ☐

16.) Do you see any weaknesses/threats after an e-health solution has been transferred from one country to another country? If "Yes", please go to question 17. If "No" or "I do not know" or "I do not care", please move to question 19.

Yes ☐

No ☐

I do not know ☐

I do not care ☐

17.) Which weaknesses/threats do you see after an e-health solution has been transferred from one country to another country? (several answers possible)

- Higher costs than an own development ☐

- Cooperation for further e-health solution development will not be used in the future and therefore e-health solutions will change differently ☐

- E-health can be used later compared with the development of an own e-health solution ☐

- Lower quality of care ☐

- Health information exchange between these countries will not be used ☐

- Inattention, because people think that all weaknesses/threats regarding data protection/data security/privacy are already known ☐

- Transferred e-health solution is not the best practice ☐

18.) Please evaluate the overall level of risk regarding the transferability of e-health solutions across countries.

Very high risk ☐

High risk ☐

Medium risk ☐

Low risk ☐

Very low risk ☐

No risk ☐

I do not know ☐

I do not care ☐

19.) Could you imagine that we will see a global e-health solution in the future?

Yes ☐

No ☐

I do not know ☐

I do not care ☐

Appendix 3:

Publications from this Thesis

Book Chapters

Zwicker, M., Seitz, J., and Wickramasinghe, N. (2014). Identifying Critical Issues for Developing Successful e-Health Solutions. In: Wickramasinghe, N., Al-Hakim, L., Gonzalez, C., and Tan, J. (eds.). Lean Thinking for Healthcare. Springer Science+Business Media, New York, pp. 207-224.

Zwicker, M., Seitz, J., and Wickramasinghe, N. (2012). Adaptations for e-Kiosk Systems in Germany to Develop Barrier-Free Terminals for Handicapped Persons. In: Wickramasinghe, N., Bali, R.K., Suomi, R., and Kirn, S. (eds.). Critical Issues for the Development of Sustainable E-health Solutions. Springer Science+Business Media, New York, pp. 99-112.

Journal Papers

Zwicker, M., Seitz, J., and Wickramasinghe, N. (2012). A Tale of Two Cities: E-Health in Germany and Australia. In: International Journal of Actor-Network Theory and Technological Innovation. Vol. 4, No. 1, pp. 24-38.

Zwicker, M., Seitz, J., and Wickramasinghe, N. (2012). Critical people considerations when designing e-health solutions: the importance of barrier-free e-kiosk systems. In: International Journal Biomedical Engineering and Technology. Vol. 9, No. 2, pp. 163-176.

Zwicker, M., Seitz, J., and Wickramasinghe, N. (2011). The Telematics Infrastructure: The Backbone of the German e-Health Card. In: International Journal of Healthcare Delivery Reform Initiatives. Vol. 3, No. 4, pp. 16-26.

Posters

Muhammad, I., Zwicker, M., and Wickramasinghe, N. (2013). Using ANT to Assess the Success of E-Health Solutions. Poster presented at Epworth Research Week 2013, 27th-31st May 2013, Melbourne.

Conference Papers

Muhammad, I., Zwicker, M., and Wickramasinghe, N. (2013). Using ANT to Understand Key Issues for Successful e-Health Solutions. In: Sprague, R.H., Jr. (ed.). Proceedings of the 46th Annual Hawaii International Conference on System Sciences (HICSS). 7th-10th January 2013, Wailea, Maui. IEEE Computer Society Press, Los Alamitos, pp. 832-842.

Zwicker, M., Seitz, J., and Wickramasinghe, N. (2012). Identifying Critical Issues For Developing Successful E-Health Solutions. In: Pan, S.L., and Cao, T.H. (eds.). Proceedings of the 16th Pacific Asia Conference on Information Systems (PACIS). 11th-15th July 2012, Ho Chi Minh City. Association for Information Systems, paper 33.

Zwicker, M., Seitz, J., and Wickramasinghe, N. (2010). An Approach of a Telematics Infrastructure for the German Electronic Health Card. In: Dillon, T., Rubin, D., Gallagher, W., Sidhu, A., and Tsymbal, A. (eds.). Proceedings of the 23rd IEEE International Symposium on Computer-Based Medical Systems (CBMS). 12th-15th October 2010, Perth, pp. 438-444.

Zwicker, M., Seitz, J., and Wickramasinghe, N. (2010). Adaptations for E-Kiosk Systems to Develop Barrier-Free Terminals for Handicapped Persons. In: Kirn, S. (ed.). Proceedings of the 2nd International eHealth Symposium 2010. Process of change in organisations through eHealth. 7th-8th June 2010, Stuttgart, pp. 67-79.