Identifying Benefits and Barriers for IS Adoption:

A Sociotechnical Framework applied to

Health Care

A Thesis submitted for the degree of Doctor of Philosophy

by

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October 2007

I and Pangur Ban my cat
'Tis a like task we are at:
Hunting mice is his delight,
Hunting words I sit all night.

Better far than praise of men
'Tis to sit with book and pen;
Pangur bears me no ill will
He too plies his simple skill.

Oftentimes a mouse will stray
In the hero Pangur's way;
Oftentimes my keen thought set
Takes a meaning in its net.

'Gainst the wall he sets his eye
Full and fierce and sharp and sly;
'Gainst the wall of knowledge I
All my little wisdom try.

Practice every day has made
Pangur perfect in his trade;
I get wisdom day and night
Turning darkness into light.

(Written by a ninth-century Irish monk in St. Gallen, Switzerland)

Abstract

The aim of this research is to propose a sociotechnical framework to identify stakeholders involved in information systems and the benefit and barriers to the adoption of such systems. The proposed framework (BEBAF) would help to acknowledge the potential problematic areas for the implementation and adoption of information systems for each actor or social group and to be able to offer solutions based on the potential benefits for each of them. Precursors of BEBAF are social construction of technology (SCOT) and stakeholder identification process.

Two case studies in the healthcare contexts, one in the UK and one in Spain, have been conducted in this dissertation using a qualitative approach to provide a rich picture of the influences on e-Health, and the users and organisational response to those influences. Both case studies aimed to support chronically ill patients at home or in nursing homes. BEBAF was then applied to both case studies.

Among the most important implications are that those systems hold the promise for improving the quality of life of patients with chronic conditions, providing a better control over the disease. However, their impact on the organisational structures, the lack of funding and the difficulties of alignment of all the actors involved are relevant constraints to their adoption into the mainstream healthcare services.

The main contributions of this thesis are: first, the definition and evaluation of a socio-technical framework to investigate IS adoption. Apart from the two closure mechanisms proposed by SCOT, BEBAF proposes a new closure mechanism by reinterpretation of benefits. In turn, the application of the framework has led to identify an extensive list of barriers and benefits for the adoption of e-Health systems with some suggested solutions. Another outcome is a comprehensive list of stakeholders involved in the adoption of such systems.

Acknowledgments

Research is a collaborative activity by nature. This thesis is an example of it and the invaluable contribution of individuals and organisations is deeply acknowledged.

First, an especial thanks to my supervisors, Alan Serrano and Guy Fitzgerald, both of whom have always been supportive, helping me through the process and orienting me with meaningful advice. Without their constructive criticism this dissertation would not have been possible.

Also my family, my husband and three kids who have always encouraged me to carry on, and helped me to work at home even when I was expected to dedicate time to them. I cannot forget in that list my parents, sisters and brothers, they have always supported me in one way or another.

Thanks to all participants, without their invaluable contribution I could not have achieved this project. Special thanks to the innovation group in the Clinic Hospital, Dr. Albert Alonso and Dr. Josep Roca and all the people in the hospital who made my research possible. Also, to the e-Vital group in London who shared their expertise and time with me.

Last and not least, thanks to all my colleagues and friends from the department who always helped me and gave me confidence to carry on, in spite of the difficulties found. I have been lucky to work with this great and heterogeneous group of people. They helped me to understand the world in a different dimension.

Many Thanks to all of you.

Declaration

The following papers have been published or submitted as a direct or indirect result of the research discussed in this thesis:

Journal Papers:

Piris, L.; Fitzgerald, G.; Serrano, A., 2004 "Strategic motivators and expected Benefits from E-commerce in Traditional Organisations". International Journal of Information Management.vol.24. pp-489-506

Fitzgerald G.; Papazafeiropoulou, A.; Piris, L.; Serrano, A., 2005 "Re-assessing the Benefits of e-Commerce" Electronic Market. Vol 15-3 , pp 225 - 234

Conference Proceedings:

Piris, L.; Fitzgerald, G.; Serrano, A., 2004 "Strategic motivators and expected Benefits from E-commerce in Traditional Organisations". UKAIS 2004 Conference proceeding, Glasgow, UK. (Best conference paper award).

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1 Chapter 1. Introduction

1.1 Background

1.1.1 e-Health systems

There is not a unique agreement about the definition of e-Health, although most of the authors consider e-Health as an umbrella term, which covers any kind of health-related activity involving distance and telecommunications (Wootton, 2001). The World Health Organisation (WHO) (1998, p.1) defines e-Health as "health-related activities, services and systems, carried out over a distance by means of information and communications technologies". According to Wootton (2001), initially, telemedicine was the most common term in the early 1990s. However, lately it has been replaced by telehealth and finally by online health, or e-Health as a larger concept, which includes their precursors telemedicine, telehealth, telecare and telehealthcare. The first telemedicine systems started in 1840s using telegraphy to communicate. However, not until 1990s have telemedicine systems risen significantly, trying to pervade most of the clinical and health specialities (Norris, 2002).

In this context there are a large number of systems that can be considered an e-Health system and different ways of classification. They can be classified according to the mode of communication used: asynchronous or synchronous (William *et al.*, 2003). An additional classification is by the clinical speciality that treats the area: teledermatology, telecardiology, teleradiology, telepathology, etc. Also, it can be classified according to the groups that are connected: medical staff with medical staff, such as expert second opinion systems; medical staff with patient, such as teleconsultation; etc (Boddy *et al.*, 1999). For this dissertation, the selected classification is the one proposed by Hersh *et al.* (2002): office/hospital-based, store-and-forward, and home-based telemedicine. In the office/hospital-based telemedicine, both patient and clinician are in a hospital or healthcare professional office, and the information is sent in real time. In the store-and-forward systems, data is transmitted for review later. In the home-based telemedicine, patients are at home or in a residential setting and

communicate with healthcare professionals directly by the use of electronic device, such as PDA, mobile phones, specific wireless computers, etc. This classification was chosen because it offers a holistic view of the patient, independent of their pathologies, which can frequently be more than one. Those systems often encompass synchronous with asynchronous communications with some information that is sent on-line and some other that is received later. Finally, they include different groups that can be the potential users of the systems: nurses, doctors, patients, general practitioners, social workers, etc.

In particular, the focus of this dissertation is home-based telemedicine for the chronically ill patient. Those systems are oriented to facilitate independent living, better communication, supervision and coordination among healthcare services and improve self-management skills for those patients with chronic conditions.

Although, some of those systems have pervaded more widely than others in the regular health practice, such as teleradiology; most of them are still to be integrated into mainstream healthcare in the target countries of this research, Spain and UK (Barlow, *et al.* 2003). In particular, e-Health systems oriented to support chronically ill patients are still in an immature stage.

1.1.2 e-Health systems to support chronically ill patients

Chronic conditions according to WHO (2002, p.11) are "health problems that require ongoing management over a period of years and decades". This category includes: Non-communicable diseases, such as cardiovascular disease, diabetes and cancer; certain mental disorders, such as depression and schizophrenia. Some communicable diseases as HIV/AIDS and ongoing impairments such as amputations, joint disorders and blindness are also considered chronic conditions. Non-communicable conditions and mental disorders represented 59% of total mortality in the world and 46% of the global burden of disease in 2000.

Some of those e-Health systems oriented to chronically ill patients are home monitoring systems, mobile monitoring and nurse monitoring systems. Home monitoring systems are based on systems to control the follow-up of the disease

and to facilitate the communication with health professionals from home, regardless of whether mobile or fixed communications are used. Mobile monitoring systems are portable systems that allow the patient to communicate with the health professional using mobile technologies at any time and at any place. Health-professional monitoring are also portable systems that are used to communicate the patient with the health professional, but the vital data and signals are collected and transmitted by a health professional, either at home or in a residential setting. The last trends are wearable systems that allow a constant communication and vital signals recording through high technology clothes that include sensors to gather and transmit the data. Wearable systems however, are still in preliminary stages of design.

E-Health systems are generally considered an important advantage for health institutions and organisations. The literature has reported the possibility of obtaining relevant benefits from these systems, such as:

- Allowing access to health independent of geographic barriers. (Wootton, 2001)
- Help health organisations to reduce costs and increase cost-effectiveness (Aoki et al., 2003; Ball & Lillis, 2001; Boddy et al., 1999; Mair & Whitten, 2000)
- Help deliver new and integrated services. (Williams, et al., 2003)
- Improve clinical evolution of the disease. (Ball & Lillis, 2001; Hersh et al., 2001)
- Increase patient quality of life (Ammenwerth et al., 2003; Aoki et al., 2003).
- Improve the role of patients and their families in their treatments (Jennett & Andruchuk, 2001).

However, not all the actors involved and not all the academic authors report similar perceptions, and for some of them these outcomes are not yet clearly demonstrated (Wootton, 2001). As a result, at this stage most of the e-Health systems developed are only pilot projects, although the advantages reported.

On the other hand, some of the barriers identified for the adoption of e-Health systems are:

- Legal issues related to information security and responsibilities. (Ball & Lillis, 2001)
- Technical difficulties with the platform and the technology. (Ammenwerth *et al.*, 2003; Aoki *et al.*, 2003; Ball & Lillis, 2001)
- Time and convenience of use for health professionals. (Richards *et al.*, 2005)
- Cost and training/familiarity in the technology. (Richards *et al.*, 2005)
- Culture of healthcare organisations and professionals to be able to adapt their process to those new paths of care delivery. (Walker & Whetton, 2002).

The variety of benefits and barriers reported in the literature suggest that there is still an unclear vision of the benefits that e-health systems can bring to the stakeholders involved in this type of system. Thus, the adoption of those systems into regular service provision seems to be delayed (William et al. 2003). The literature reports that actors involved in those systems have different perceptions and attitudes towards them and there is no agreement about the potential benefits and the barriers to overcome. In this context, this research argues that a socio-technical approach to investigate the potential benefits and barriers of e-health systems could help to a) better understand the benefits and barriers of such systems b) better identify the stakeholders involved and c) to unify the views of the stakeholders involved.

1.1.3 Social Construction of Technology

Social construction of technology (SCOT) is a multi-directional model developed by Pinch and Bijker, (1984) based on the philosophical assumption that technology is socially constructed. They joined SCOT with the more prevalent social constructivist view in science studies: The Empirical Programme of Relativism (EPOR) an approach to sociological studies of scientific knowledge (Collins, 1983, cited in Pinch & Bijker, 1984). Precursors of SCOT were the

studies of technology developed by Bijker *et al.* (1982, cited in Pinch & Bijker, 1984).

SCOT was developed further by Pinch& Bijker (1987, 1989) and by Bijker (1994, 1995), in an attempt to demonstrate that in any technical development, not only engineers participate and the process does not follow a linear stage by stage model, but a messy, circular practice in which no stages can be distinguish and different social groups participate.

SCOT proposes first to identify the relevant social groups: individuals or organisations who are involved in the technology. However, SCOT does not propose any specific method or approach to identify them. Hence, less obvious groups could not be identified. Moreover, groups that could be heterogeneous in their viewpoints are consider as a unique group. This was developed further by the more recent work of Bijker (1995), in which to use a snowball process for identifying relevant social groups is suggested.

At a second stage, SCOT proposes to identify problems, conflicts or barriers for each group and possible solutions for each issue. The degree of stabilization could be different and each social group would lead to a different chain of problem solutions and thus to a different technology. This stresses the relevance of considering the maximum number of stakeholders involved.

SCOT suggests two ways of closure: rhetorical closure and closure by redefinition of the problem. The first closure is related to closing the controversies or barriers. It does not mean to solve it in the common sense of the word, but change the perception of the issue as being resolved. Advertising has been commonly used to change or minimise the perception of a problem within a social group. The second closure: Closure by Redefinition of Problems, proposes to redefine some perceived issues as a solution for quite another problem, and hence change the perception of it by redefining the problem. Finally, those closure mechanisms are linked with the "wider socio-cultural milieu". This is, according to the authors a straightforward process, because of the mutual

influence of the social and political context in the perception of the stakeholders. Hence the context influences in the definition of the problem.

SCOT model is particularly useful to take into consideration the process of adoption and diffusion of new technology artefacts, such as complex e-health systems. It addresses the perception of different social groups or stakeholders and tries to define a problem-solution chain for each of them. It will help to provide a wide map of problems and solutions, which can contribute in understanding the e-health systems and improve the design and adoption of new ones.

SCOT model, which is focused on identifying the problems or different interpretations for each group, and also finding the solutions. However, it gives very little attention to identifying what the expected benefits for each social group are and what the opportunities are that can arise from it. This research advocates that adding benefits and opportunities to the model will reinforce it and provide new ways of stabilization and closure.

Additionally, SCOT shares with stakeholder theories the importance given to a proper identification of relevant social groups or individuals, namely 'stakeholders'. However, stakeholder models (Pouloudi & Whitley, 1997) seem to be more accurate and have the potential to provide a strong understanding.

1.1.4 Stakeholder theory

This research advocates that stakeholder analysis can strengthen social construction of technology framework by providing an analytical tool to identify stakeholders and assess their perceptions towards e-Health systems. However, the two main debates that arise using stakeholder theory are that on the one hand there is the lack of agreement about the definition of stakeholder and on the other hand the different uses of it.

The roots of stakeholders are in the management literature, and most of the reviews accept that Freeman was the first academic author to deeply develop the concept. However, according to Key (1999), there are explicit mentions to the

importance of groups or individuals in the achievement of organisation objectives in the work of Adam Smith (1937), Barnard (1938) and Abrams (1951) among others.

These theories have pervaded the IS context since the 80`s. Most of the time however, the concept has been used in the IS literature in a very general way (Pouloudi & Whitley, 1997; Pouloudi, 1998); in which, only users, managers and developers were recognised as stakeholders (Atkinson et al. 2002). This approach is clearly insufficient in e-Health systems in which there are a relevant number of different participants or stakeholders involved in each system from different organisations and with a different role to play in a complex network of relationships.

Principles of Stakeholder Behaviour	Implications for Stakeholder identification and analysis
- The set and number of stakeholders are context and time dependent - Stakeholders cannot be viewed in isolation - A stakeholder's role may change over time - Stakeholder may have different roles - Different stakeholders may have different perspectives and wishes - The viewpoints and wishes of stakeholders may change over time. - Stakeholders may be unable to serve their interests or realise their wishes.	- Stakeholder map should reflect the context - Stakeholder map should be reviewed over time - Consider how stakeholder are linked - Adopt a long-term perspective: study how perceptions change - There are different versions of stakeholder maps to be drawn - These different versions should be reviewed over time - Need to consider political issues (as well as technical, economic, etc.)

Table 1.1 Principles to identify stakeholders.

In 1997, Pouloudi & Whitley defined a practical method for the identification of stakeholder. This method was developed further by Pouloudi (1998), who proposed an iterative framework to identify stakeholders (Table 1.1). In this framework, a set of principles is defined to identify obvious and not so obvious stakeholders in complex information systems with several organisations involved. In particular this framework was used and validated for the identification of stakeholders for a drug support information system. A context

with significant similarities with the one focused in this dissertation: several health organisations involved and several different users.

This dissertation argues that this framework used in combination with SCOT can help to improve the identification of stakeholders or interest groups and individuals involved in complex information systems. This process is especially relevant when factors such as distance and time are inherent in the virtual providing of health related services.

1.2 Research aim:

The aim of this research is to propose a sociotechnical framework to identify stakeholders involved in e-Health information systems and the benefit and barriers to the adoption of such systems.

The proposed framework would help to acknowledge the potential problematic areas for the implementation and adoption of information systems for each actor or social group and to be able to offer solutions based on the potential benefits for each of them.

1.3 Objectives:

According to the previous research statement, the following objectives are presented:

1. Based on literature review, to propose a socio-technical framework to identify the stakeholders involved in e-Health information systems and assess the benefits and barriers for each group.
2. To perform an exploratory case study in a e-Health system. This case study will help to identify the list of stakeholders involved, and a preliminary list of benefits and barriers for such systems. Additionally, this previous study will help to refine the research methodology, the hypothesis and the framework.

3. To conduct a case study research in an e-Health system applying the proposed framework. The selected system will be a relevant case study of a system oriented to support chronically ill patients. The main source of data collection will be through interviews, plus observation, study of documents and websites. The outcomes will be the identification of stakeholders involved in several e-Health systems, their perception about the system, expected benefits and barriers, and finally some possible solutions.
4. To evaluate and validate the proposed framework and the findings from the case studies. For this purpose a theoretical evaluation of the framework will be applied. Additionally, a data triangulation will be conducted with the findings from both case studies and the literature review.

1.4 Research strategy

For this research an interpretative epistemology has been considered as the most suitable. In the Information Systems arena, the use of interpretivist research has become more common in the last two decades. Although a scientific position based on positivist methods is still the predominant approach (Chen & Hirschheim, 2004), from an interpretivist position, social science and social methods of research have an important role. In this context, the multidisciplinary nature of Information Systems is better reflected because the socio-technical impact is taken into consideration. Qualitative methods can help to understand the role of organisations, people and technology and their interrelationships. Information Systems are social systems in which technology is just one of the aspects (Galliers, 1992).

Hence, this research will follow a qualitative approach based on interpretivist epistemology. Case study has been chosen as the method of research because of its potential to provide a richer picture of the influences towards e-Health and the users and organisations response to those influences (Yin, 2003). Hermeneutics has been used as well as the philosophical background, to provide a picture of the system into the context and of each actor as interrelated among them and with the

context, into the hermeneutic circle (Klein & Myers, 1999). This subject is developed further in Chapter 4.

The data will be collected using the following research techniques:

- Semi-structured interviews with the different stakeholders involved in the systems under study. Those interviews will be recorded and transcribed.
- Questionnaires to some of the stakeholders to whom the access would be more limited.
- Attendance and observation of different sessions: training sessions, health-related appointments, and research group sessions.
- Interaction and study of the information system in use.
- Observation of different groups of users while interacting with the information systems.

1.5 Thesis outline

This thesis will have seven chapters, with the following contents:

- **Chapter** 1. Introduction: This chapter contains the introduction for this dissertation and background area. An introductory literature review of the most relevant topics is presented. It is followed by the research aim and objectives, and a brief description of the selected research method.
- **Chapter** 2. Literature Review: This chapter contains the literature background of this dissertation. The objective is to identify current practice on e-Health. The main areas that are developed are: (i) e-Health definition, boundaries and the different classifications. (ii) The integrated care system presented by the World Health Organisation (WHO) in 2002 as a response to the increase in chronic condition worldwide. (iii) A meta-analysis of previous outcomes about benefits and barriers of e-Health reported in the relevant academic literature (iv) Social construction of technology (SCOT). (iv) Stakeholder theory, with a special focus on its applications on health Information Systems and in particular on e-Health.

- **Chapter** 3. Research Strategy: In this chapter the research strategy is presented and justified. Firstly, a general introduction of the qualitative research methods is presented. Afterwards, the research method chosen and its appropriateness are discussed. It is followed by an introduction of the context in which this research has been conducted: the UK and Spanish healthcare system. The data collection and the data analysis methods are explained afterwards. Finally, evaluation strategies are critically discussed.
- **Chapter** 4. In this chapter, first the proposed framework to assess the benefits and barriers of e-health applications is presented. The framework is based on social construction of technology and stakeholder theories and it was defined using the literature review of the area. The second part of this chapter is dedicated to conducting an exploratory case study to validate the proposed framework with real data. The case study was conducted in the UK and aimed to investigate the use of remote patient monitoring.
- **Chapter** 5. In this chapter the second case study conducted is presented and described in detail. The case study chosen aimed to investigate the use of mobile technologies in home-based telecare and it was conducted in Barcelona, Spain. First, the data collected following the structure of the framework is presented. The second part covers the application of the framework and the analysis of the findings.
- **Chapter** 6. This chapter contains the evaluation of the framework and the findings of both case studies. A theoretical evaluation of the framework is performed. It is followed by a data triangulation (Murphy *et al.*, 1998) with the findings from both case studies and the literature review of the area.
- **Chapter** 7. This final chapter presents the most relevant conclusions and implications of this research. Afterwards, the thesis is summarised chapter by chapter. It is followed by the presentation of the contributions of this research and the limitations. Implications for further research are discussed subsequently. Finally, the research and personal reflections are examined.

The structure of the thesis showing the outcomes of each chapter is graphically represented in fig. 1.2

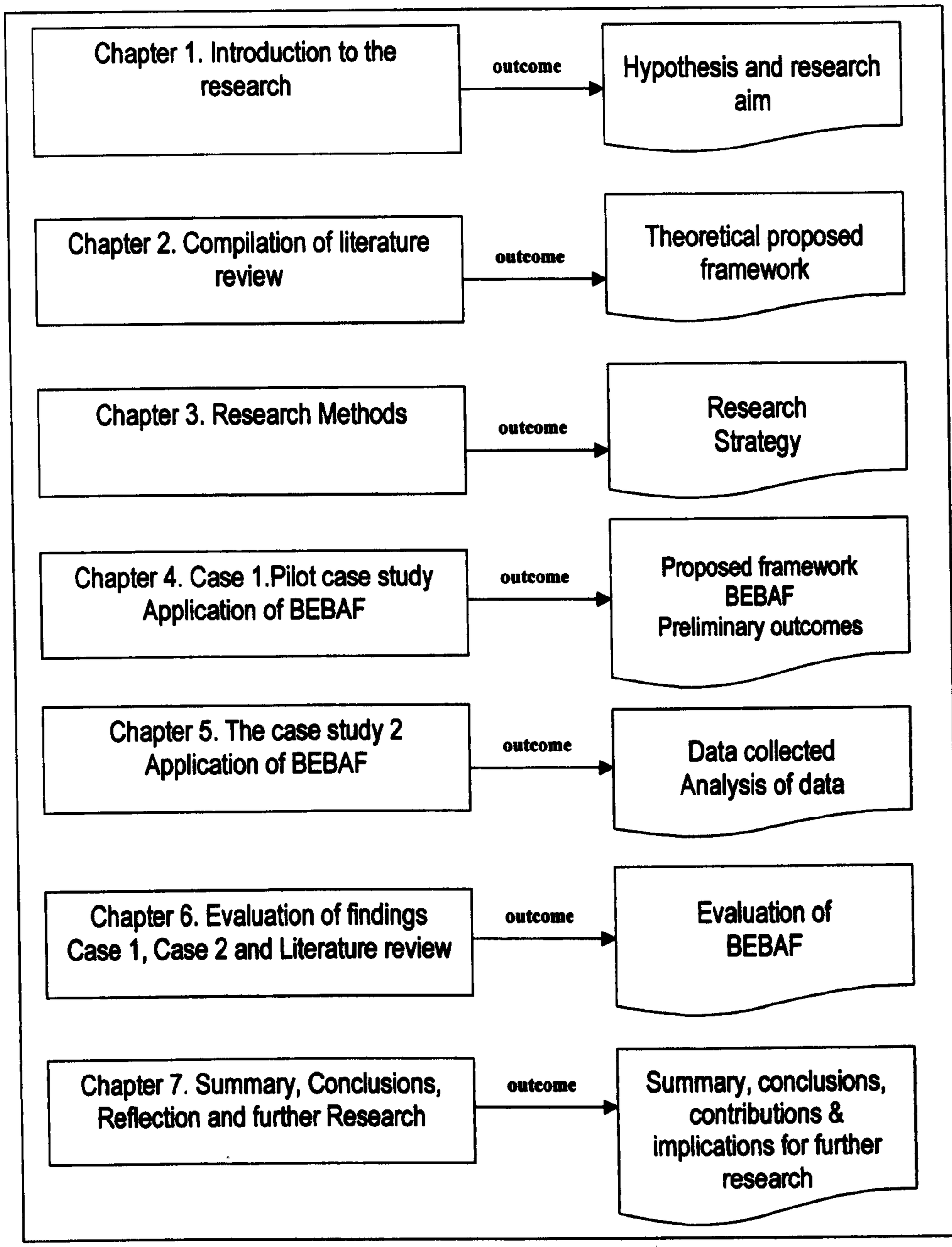

Fig.1.2 Graphical Representation of the Thesis Structure

2 Chapter 2. Literature Review

2.1 Introduction

The aim of this chapter is to present a review of relevant academic literature related to this dissertation: e-Health systems, benefits and barriers to the adoption of such systems, and the theoretical frameworks used in this dissertation: Social Construction of Technology (SCOT) and Stakeholder theory.

Firstly, the definition of e-Health and a brief history of it are presented. In this section the specific telemedicine systems oriented to support chronically ill patients are introduced within the integrated care system. The integrated care systems were presented by the World Health Organisation (WHO) in 2002 as a response to the increase of chronic conditions worldwide. Finally, a meta-analysis including previous research on benefits and barriers to such systems is presented.

The last sections deal with the theoretical background of this dissertation: The Social construction of Technology (SCOT) and Stakeholder theory. Both streams of opinions are reviewed from their origins, paying particular attention to their applications in healthcare information systems.

2.2 E-Health

2.2.1 Evolution and Definition

It is generally accepted that e-Health is an umbrella term that includes and even sometimes replaces, terms such as telemedicine, telehealth, telecare, telehealthcare, remote patient monitoring (RPM) and telemonitoring. Often those terms are used in a very similar way. Some of those definitions are presented in the table 2.1.

Definition	Author
"Application of information and communication technologies (ICT) across the whole range of functions which, one way or another, affect the health of citizens and patients"	European Commission 2007 p.1
"Health-related activities, services and systems, carried out over a distance by means of information and communications technologies".	Who p.1 1998)
"Telemedicine is an umbrella term that encompasses any medical activity involving an element of distance....., this too has been overtaken by even more fashionable terms such as online health and e-health"	Wootton, 2001 p.323
"E-Health is the application of information and communications technologies (ICT) across the whole range of functions that affect healthcare, from diagnosis to follow-up"	Silber, 2003. p.vii

Table 2.1 Definitions of e-Health

Despite the diversity of definitions, all of them agree with the idea that e-Health covers healthcare services provided over distance and facilitated by the use of technology. In this context, e-Health includes a variety of information systems, with often a blurred border among them. One of the most common ways of classifying e-Health systems is based on the medical domain where the systems will be deployed: telediabetics, teledermatology, telepathology. Other classification is based on the mode of communication paradigm used by the system, namely Asynchronous or Synchronous (table 2.2). The classification chosen in this dissertation is the one proposed by Hersh *et al.* (2002): office/hospital-based, store-and-forward, and home-based telemedicine, which offers a holistic view of the patient, in particular it is focused on e-health systems oriented to support chronically patients.

Mode	Delivery	Representative clinical specialities
Asynchronous (Store & Forward)	Out of 'real time': digital recording, processing and storage of images and data for subsequent transmission and review.	Dermatology Radiology Pathology
Synchronous (Interactive)	In 'real time'; for example, Videoconferencing systems, with parallel transmission of clinical data (documentary; still images, e.g.: x-rays, ECG data or other vital data; audio signals, e.g. heart or lung sounds)	Psychiatry/psychology Cardiology Trauma/emergency Respiratory Home telecare/nursing

Table 2.2 Modes of telehealthcare: Adapted from (Williams et al. 2003)

Although previous studies have reported important benefits that can arise from those systems, there is not a clear agreement about them and also not all the studies reported the same benefits (Barlow *et al.*, 2005). In most countries those systems are not yet fully adopted. Most of the systems are still pilot projects or small implementations, with limited amount of patients (Hebert & Korabek, 2004; Hebert *et al.* 2004; Barlow *et al.*, 2003). Still, more evidence of benefits is needed, due to the limited amount of studies in the field (Hailey *et al.* 2004). In this scenario, this dissertation intends to identify which benefits and barriers can be expected for the different actors involved.

One of the reasons for such limited adoption is that the implementation of telecare systems induces an important change in the way health services are delivered. It affects the way healthcare organisations are managed; and most importantly the way healthcare professionals interact among them and how the healthcare services are delivered (Berg *et al.* 2003). The very nature of healthcare work is interpretative, interactive and pragmatic (Aarts & Berg, 2004). Hence, the standardisation of work processes necessary to fully adopt those systems is difficult to achieve. WHO (2002) proposed the integrated care system as a solution for this challenge.

2.2.2 The integrated care system

In 2002, the World Health Organisation (WHO) proposed a new system to overcome the burden of chronic condition around the world and to improve the follow-up of those diseases. According to them the actual healthcare systems in developed countries share similar characteristics that need to be changed to provide a better response to this situation. The issues detected were:

(i) They are organized to provide acute illness care, rather than chronic care. Care is fragmented and focused on acute and emergent symptoms. Acute care is based on short term medical treatment, for patients with rapid and abrupt symptoms that are often in need of urgent medical intervention.

(ii) The role of the patient is not emphasized and self-empowerment is not promoted

(iii) Follow up is sporadic, and normally not until their symptoms become intolerable.

(iv) Community services tend to be ignored. Healthcare often tends to pay little attention to any programs from outside the same system, like patient associations, non-governmental organisations and consumer groups.

(v) Prevention is under-utilised. Although most chronic conditions are preventable, prevention programs are far from the routine clinical care.

The framework proposed by WHO for "innovative care for chronic conditions" is based on the collaboration of all stakeholders involved (Fig. 2.1). The framework is a patient-centric model in which patients are in the centre of the model and all the healthcare providers are coordinated to provide better and more effective health services. The model is focused on the idea that optimal outcomes arise when there is a strong partnership among patients and families, healthcare providers and community partners.

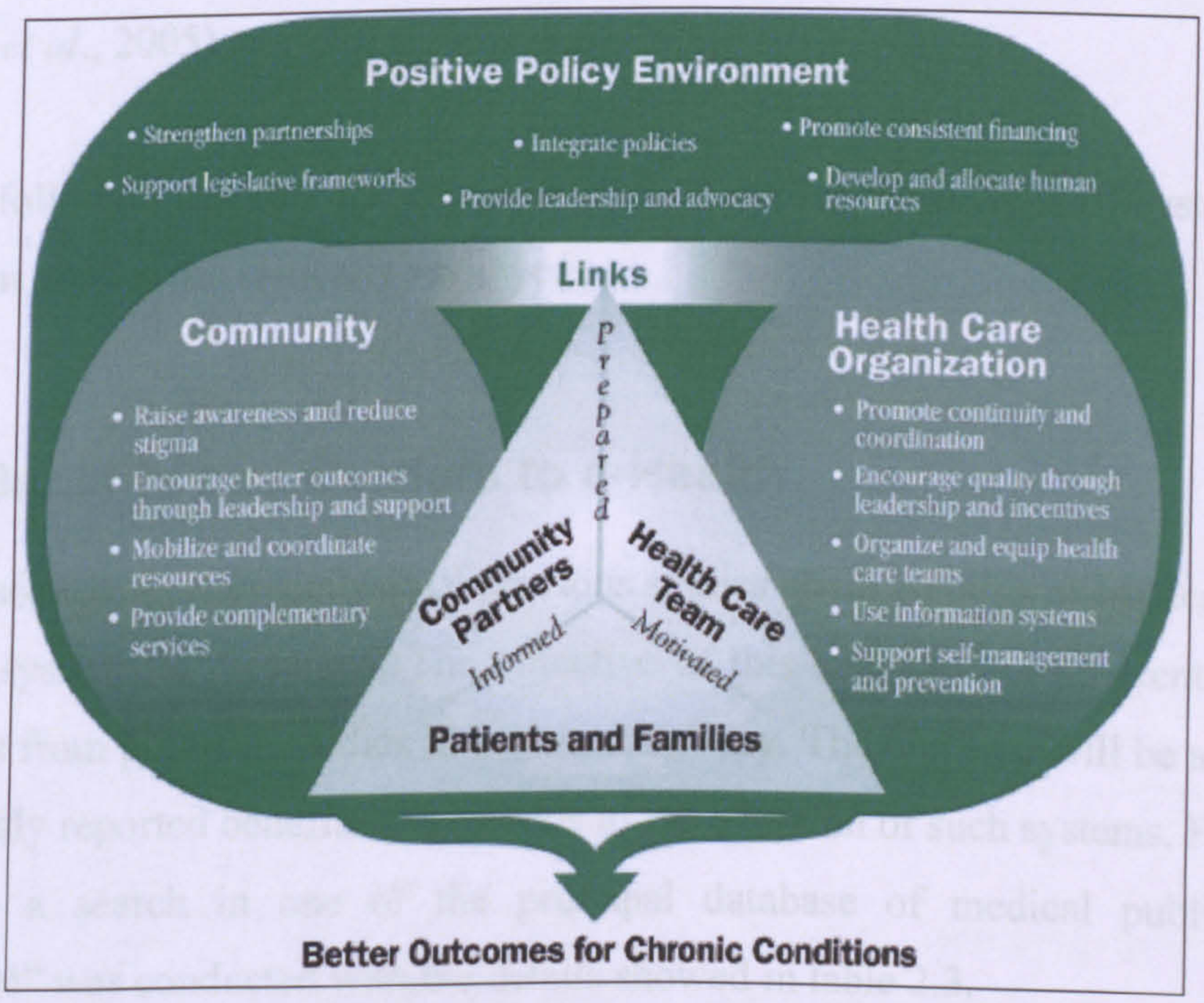

Fig. 2.1 The chronic care model (WHO)

One of the main problems to integrate this model is the difficulty of fitting in with the actual healthcare organisations. In the target countries of this research the healthcare organisations are fragmented and often not coordinated (Atkinson *et al.* 2001). Changing the way these organisations provide healthcare services is difficult and requires the consensus of all groups involved (Lehoux *et al.* 2002). To be able to implement such a system, it is necessary to take into consideration not only technology, but also organisational, clinical, professional and political issues of all the organisations, groups and individuals involved. At the heart of the system is the need for managing the patient trajectory into the healthcare system from the very beginning and across the organisational boundaries (Berg *et al.* 2003). How the patient goes through the different stages of his/her disease and is transferred to different medical services and organisations is fundamental in such systems.

However, this model needs strong information and technical support to be successful. In particular, E-Health or telemedicine systems are considered as a key factor in the success of the integrated care model (Alonso, 2004). However, the complexity of the network of stakeholders involved demands further research taking into consideration the diversity of perceptions (Pouloudi & Whitley, 1997; Lyons *et al.*, 2005) .

In the following section, the reported perceptions for those types of systems by previous studies are critically reviewed.

2.3 Benefits and Barriers to e-Health

In this section, a meta-analysis of previous studies about benefits or barriers of e-Health systems is presented. The objective of this analysis was to identify the findings from previous studies in a systematic way. The outcome will be a list of previously reported benefits and barriers to the adoption of such systems. For this purpose a search in one of the principal database of medical publication "Pubmed" was conducted with the details showed in table 2.3.

Query: ("telecare"[All Fields] OR "telemedicine"[All Fields] OR "e-Health"[All Fields] OR "ehealth"[All Fields]) AND "review"[All Fields] AND ("benefits"[All Fields] OR "advantages"[All Fields] OR "barriers"[All Fields] OR "drawbacks"[All Fields]) AND ("home"[All Fields] OR "homecare"[All Fields]) AND ("chronic"[All Fields] OR "long term"[All Fields])

Table 2.3 Search details

The abstracts of this preliminary list were studied in detail and from this list three publications were selected. Four additional publications were selected from a new query conducted from the three more relevant academic journals in the area: "Telemedicine journal and e-Health", "Journal of Telemedicine and Telecare" and "International Journal of Medical Informatics". The final list of publications is shown in table 2.4. The criteria for selection were the relevance and number of studies showed, the inclusion of projects related to "Chronic healthcare" and the relationship to the topic under study. Some of the papers discharged from the meta-analysis were for differences in the focus of the review. They were not focused on identifying positive or negative effects of the adoption of such systems. Others were discarded because the telemedicine systems were not similar to those under study. Finally only publications published from 2000 onwards were selected.

• (1) (Aoki *et al.*, 2003).
• (2) (Hailey *et al.*, 2004)
• (3) (Hersh *et al.*, 2001). (Hersh *et al.*, 2006)
• (4) (Mair & Whitten, 2000).
• (5) (Hjelm, 2005).
• (6) (Richards *et al.*, 2005).
• (7) (Ball *et al.*, 2001)

Table 2.4 List of selected review publications

An analysis of the selected publications was conducted, searching for benefits and barriers for the adoption and classifying the themes into categories, using content analysis. Six categories were identified: professional, patient-related,

organisational, economic and technical issues. Clinical issues were related to the clinical aspects of the diseases. Professional issues were related to the themes that affect the professional healthcare work. Organisational issues were related to the organisational structures and the work procedures. Patient-related issues were those related to the patients' condition and perception. Finally, economic issues were related to costs and funding matters. The outcomes are shown in tables 2.5 to 2.13, divided into the six categories previously mentioned (Original sources are presented in Appendix C). Those benefits and barriers mentioned by more than one source are highlighted in grey.

Clinical Benefits	1	2	3	4	5	6	7
Decrease hospitalisation		√	√		√		
Improve Patients' Compliance to treatment		√	√				√
Reduction of mortality	√	√					√
Improve the control over the disease problem. Speed-up clinical process			√				√
Improve clinical outcomes			√				√
Decrease hospital admission days.			√		√		
Increase of Clinical Usefulness						√	
Improve Diagnostic accuracy and help with diagnostic decisions	√						
Reduction of morbidity-reduce the capacity to develop the disease (increase the prevention)	√						
Decrease nursing home placement			√				
Reduce the health risk of sitting in waiting rooms							√
Reduce complications due to hospital admission			√				

Table 2.5 Clinical Benefits

Professional Benefits	1	2	3	4	5	6	7
Offer professionals access to information, reference materials and standard of care.					√		√
Agreement with the diagnosis	√				√		
Change the way healthcare professionals are practising.							√
Allow a stronger focus on disease management							√
Ensure that patient information is just acquired once.							√
Provide access for professionals to accurate patient medical records.							√

Table 2.6 Professional Benefits

Patient-related Benefits	1	2	3	4	5	6	7
Improve patient care, quality of life and satisfaction	√	√	√		√		√
Improve the Ability of self-care			√		√		√
Increased patients' accessibility to specialist expertise		√		√	√		
Improve patients role and participation in healthcare			√		√		
Improve communication between health professional and patients.					√		√
Avoid Patient transfer	√						

Improve Knowledge of the disease					√		
Improve social support and reduced social isolation			√				

Table 2.7 Patient-related Benefits

Organisational/Economic benefits	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Cost reduction	√	√		√	√		√
Reduce the transport of health professionals and patients	√	√		√			√
Reduced patients waiting times	√			√	√		
Improve efficiency of care	√				√		√
Redistribute resources and the work load		√			√		
Indirect cost reduction	√						
Increase accessibility of specialist expertise					√		
Helpful to rationalise the access to different resources					√		
Allow collaboration between different levels, increasing communication between health professionals					√		
Reduce unscheduled hospital visits			√				
Provide equal access to health quality healthcare no matter where					√		
Reduce number of house calls			√				

Table 2.8 Organisational and economic Benefits

Organisational Barriers	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Lack of suitable training					√	√	
Increase in GP/nurse workload					√	√	
The area is still emergent		√			√		
Change Resistance in some healthcare professionals. Nurses and primary care doctors					√		
Lack of top management support							√
Social & political issues. Lack of vision from authorities							√

Table 2.9 Organisational Barriers

Patient-related Barriers	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Lack of self-management skills on patients							√

Table 2.10 Patient-related barriers

Technical Barriers	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Concerns about the impact of telemedicine on patient privacy					√	√	√
Lack of standards in the data codification. Need to use similar codification for all the professionals involved					√		
Technology is still immature: Failures & Flaws that may cause negative effects on patients and staff		√					
Mobile communication is still immature: Bandwidth is needed	√						
Usability in certain groups of patients.	√						
Resolutions & colour in digital images	√						

Table 2.11 Technical barriers

Professional Barriers	1	2	3	4	5	6	7
Disquiet about the mode of healthcare delivery (communication between professional and patient)				√	√	√	
Trust in technology. Healthcare professionals are reluctant to use technology					√		√
Lack of powerful arguments in favour of those systems		√			√		
Healthcare professionals need to get used to different way of working					√		
Change of role for professionals. Nurses empower their role. The patients empower their role in the system					√		
Difficulties with the extra time that health professionals have to dedicate. Without economic reward					√		
Most of the projects have not been lead by healthcare professionals and has been more technology or market driven					√		
Power factors between healthcare professionals					√		

Table 2.12 Professional barriers

Economic Barriers	1	2	3	4	5	6	7
High cost of buying telemedicine equipment		√				√	
Still projects need to demonstrate that are cost-effective and that increase quality of life.		√			√		
Financial issues among organisations. Reimbursement issues. Change in the business model					√		

Table 2.13 Economic reported

The reported studies presented a relevant list of benefits. However, less than half of them are reported for more than one author. Even though, these publications were review research, which show the compilation of several research papers in the area. This limited agreement about what can be expected from the adoption of those systems could be one of the reasons for the delay in the adoption of telecare systems (Hailey *et al*. 2004), (Hebert & Korabek, 2004), and one of the motivators of this dissertation.

One of the reasons for this limited picture could be: the immaturity of the systems and the small samples. Studies in the area are still in an emergent stage and most of the implementations are pilot projects with a small number of patients involved, which implies a limited knowledge of the area (Hebert *et al.* 2004); (Hebert & Korabek, 2004).

Another reason is the limited amount of studies with a qualitative approach (van't Riet *et al*. 2001). Quantitative methods of research are the most commonly used in the medical domain. However, e-Health systems are a multidisciplinary field

and the use of qualitative methods can add new insight. The complexity of human factors involved in the adoption and use of those systems and the very nature of the healthcare work make it necessary for a different approach (Berg *et al.*, 2003). Qualitative methods might help to understand the findings within the complex network of participants.

In this context there is a stream of opinion, which advocates for a socio-technical approach to research of information systems in the healthcare domain (Berg *et al.* 2003; Aarts & Berg,. 2004). Telemedicine is still unstable in clinical practice and needs to stabilise their practices and knowledge (May *et al.* 2001). In the clinical practice of telemedicine the boundaries between the social and the technical nature are difficult to find and often in an ambiguous way. (May *et al.* 2001). A way to understand practices could rely on a critical interrogation of social and technical processes and how these practices are constructed and agreement is reached (May *et al.* 2003). Socio-technical frameworks have the potential of adding a way of understanding how social and technical aspects are inter-related and need to be studied together and intrinsically joint rather than as separated facets.

It does not mean that quantitative methods, such as randomised controlled trials are not needed. Indeed they are crucial in being able to produce quantitative variables and knowledge about the evaluation of the system and the clinical practice (May *et al.* 2003). However, a socio-technical approach can help to understand how technology is socially produced, and explains the why and how of the adoption of such systems.

2.4 Social Construction of Technology

Social Construction of Technology (Fig.2.2) as introduced in chapter 1, advocates a multidirectional model that represents the process of alternation and selection (Pinch & Bijker, 1984) and developed further by Bijker, Hughes and Pinch (1989) and Bijker (1994, 1995). In this model, not only the optimum combination is presented but also other possible variations according to the different interest groups.

It belongs to the growing practice of using social science theories and methods to explain how information systems shape, and are shaped by the social context in which it is developed. The combination of social science tradition into the technology world has provided a way of understanding and evaluating information systems. It is based on the idea that reality is a social product, impossible to understand independently of the social actors or groups that construct and make sense of it (Orlikowski & Baroudi, 2002).

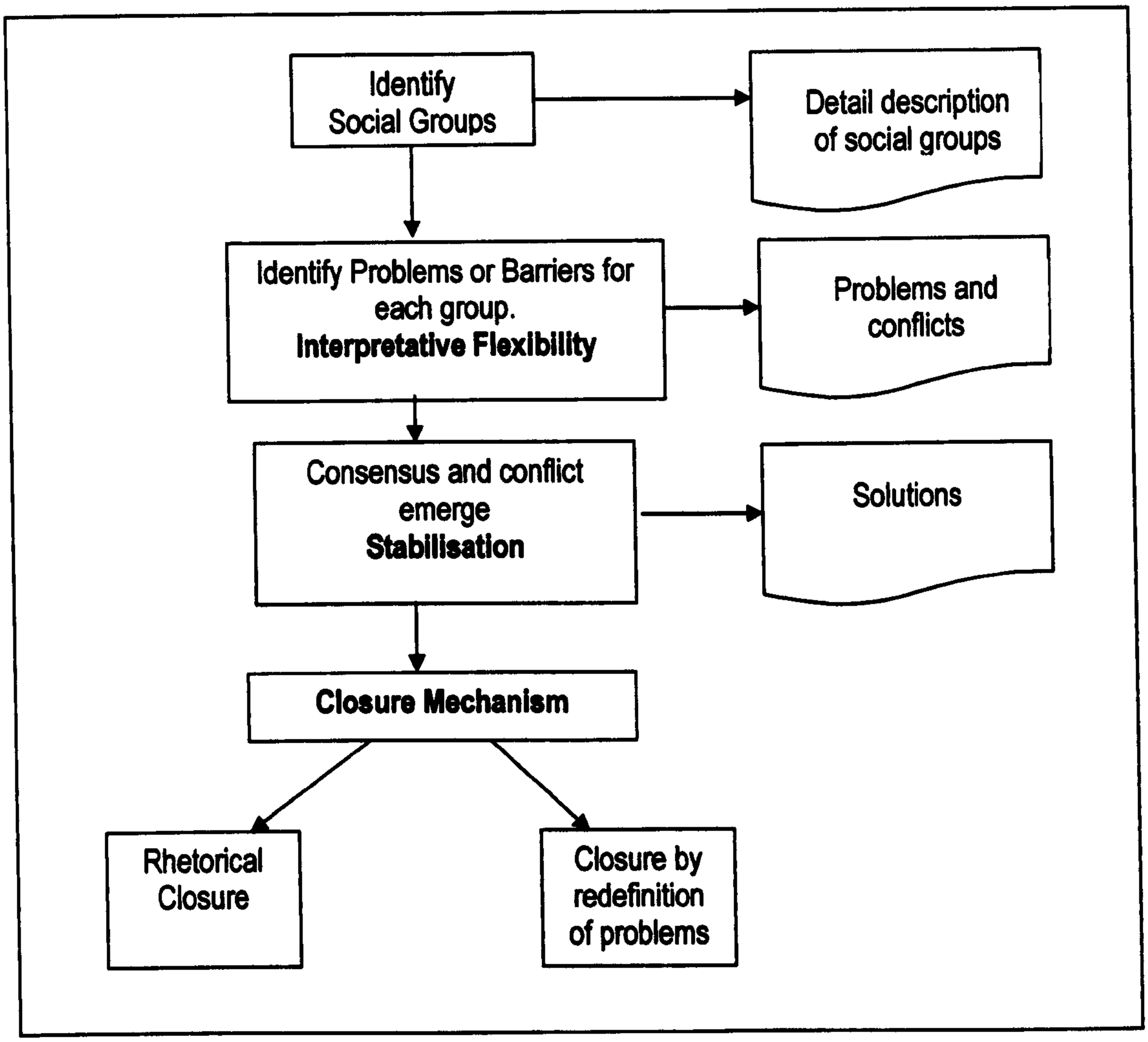

Fig. 2.2 Social Construction of Technology Model (SCOT)

They proposed an analysis based on the three stages of analysis of EPOR: Interpretative flexibility, stabilization and finally closure mechanism. The interpretative flexibility is the first stage in which there is not a consensus about

the technology. Several problems or conflicts emerge and they are interpreted in a different way. Consequently, different solutions emerge to resolve each problem. A second stage is when consensus emerges and a stage of stabilization is achieved and closure mechanisms are identified. Finally those closure mechanisms are linked with the "wider socio-cultural milieu".

SCOT model proposed first to identify the relevant social groups, which are defined as:

> 'Institutions and organisations (such as the military or some specific industrial company), as well as organised or unorganised groups of individuals' (p. 414).

Although SCOT includes group identification, its limitation in this area was already cited by Winner (1993). Who decides what are relevant social groups and what might happen with this other groups that have no voice, but could be affected by this new technology are important issues highlighted by Winner (1993). In addition, power asymmetries, groups impact by technology (Klein & Kleinman, 2002) and iteration in their identification are issues not taken into account in SCOT. Though, more recent work of Bijker (1995) proposed to use a snowball process for identifying relevant social groups. However, this snowball process is not a guarantee of completeness and accuracy, and unrecognized and missing participants could remain unidentified (Klein and Kleinman, 2002).

At a second stage, SCOT suggests identifying problems, conflicts or barriers for each group and possible solutions for each issue. The degree of stabilization will be different for each social group and it is always a matter of degree. Indeed, each social group will lead to a different chain of problem solutions and finally to a different system. This highlights the importance of taking into consideration the maximum number of actors involved.

SCOT proposes two ways of closure: rhetorical closure and closure by redefinition of the problem. The first closure is related to closing the controversies or barriers. It does not mean solving it in the common sense of the word, but changing the perception of the issue as being resolved. Advertising has

been commonly used to change or minimise the perception of a problem within a social group. The second closure: Closure by Redefinition of Problems, proposes to redefine some perceived issues as a solution for quite another problem, and hence change the perception of it by redefining the problem.

Finally, the last stage is to relate the system to the socio-political milieu. According to the original authors, it is a straightforward process. Socio-cultural and political context influences each social group and hence this influence is shown in the definition of the problem.

SCOT model is particularly useful to take into consideration the process of adoption and diffusion of new technology artefacts, such as complex e-health systems. It addresses the perception of different social groups or stakeholders and tries to define a problem-solution chain for each of them. It will help to provide a wide map of problems and solutions, which can contribute in understanding e-health systems and improve the design and adoption of new ones.

It is frequent to find studies that apply socio-technical approach to the study of healthcare information systems. One of these examples is the failed implementation of a telemedicine system between a hospital and a outpatient clinic (May *et al.* 2001). In this research the conflict emerges when applying soft-technologies undermining hard-technologies. This research aimed to understand how and why this implementation of a telemedicine project failed. The interaction of the different social groups was key for this result. This case study is an example of how properly working technology can be undermined by; soft-technologies. In other words, the way technology is interpreted and used was the key factor for the success or failure of the system.

An additional use of SCOT is the research about the addition of interpretative flexibility to the innovation diffusion process (Papazafeiropoulou *et al.* 2005). The different groups involved had different opinions about the stage of innovation at the same time. Closure mechanisms from SCOT can help to reach an agreement, providing the decision maker with a more realistic picture of the system under development.

Another significant contribution is the research conducted by Faraj, *et al.* (2004) in which the development of the web browser is analysed using actor-network theory. This research identifies three processes of inscribing, translating and framing that provides a clear insight in how stakeholders act and react with each other and how their interdependencies shaped the development of web browser.

In the same line, Braa *et al.* (2004) highlighted the importance of the networks of participants in the health care sector in developing countries and how health information systems need to engage in politics, specially when controlling scare healthcare resources such as vaccination.

In the research conducted by Wilson and Howcroft (2002), a sociotechnical approach was applied to information systems success and failure. This research was applied to a Nurse information systems. It helped to identified, how similar factors might be considered failure or success factors depending on the social group and the interpretive flexibility. Technology was perceived differently over time without making any changes on it, and social studies of technology might help to understand these apparent contradictions. Going further with the same case study, issues as how gender shape technology and how it affects the information systems arena was developed in conjunction with social studies of technology by Wilson (2002). This research provided a new insight in how gender affects interaction between social groups and how some jobs are more gendered than others.

As presented in previous examples, SCOT has demonstrated to have been a very useful framework to investigate the interrelationships of social networks in the success or failure of a system. In particular in the healthcare context, in which the number of organisations and individuals involved adds an additional complexity.

The SCOT model is focused on identifying the problems or different interpretations for each group and finding the solutions. SCOT however, pays very little attention to identifying what the expected benefits for each social group are and what the opportunities are that can arise from it. This research

advocates that adding benefits and opportunities to the model will strengthen it and provide new ways of stabilization and closure.

Additionally, SCOT shares with stakeholder theories, the importance given to a proper identification of relevant social groups or stakeholders. However, the stakeholder framework developed by Pouloudi and Whitley (1997) is a more structured and systematic way of identifying obvious and not so obvious groups involved. This framework has the potential to provide a strong understanding of which those groups are and what their influence over the system is.

2.5 Stakeholder theory

2.5.1 Origins of stakeholder theory

Stakeholder theory has its roots in the management literature in which it has been largely used. Freeman (1984) was the first academic author who started to use a wide concept of "stakeholder" and developed a theory in which the role of external and internal actors apart from stockholders would impact the firm in many aspects, and specifically in the strategic area. Freeman (1984) defined stakeholder as "any group or individual who can affect or be affected by the achievements of organisation's objectives".

According to Key (1999), precursors of the stakeholder theory were: Adam Smith (1937, cited in Key, 1999) who identified that there could be external interest parties in each organisation; Barnard (1938, cited in Key, 1999) who suggested the impact of employees in firm success; Abrams (1951, cited in Key, 1999) who identified three corporate stakeholders apart from stockholders: employees, customers, and governments; In the 60s Eells (cited in Key, 1999) expanded the number of stakeholders to address a more pluralistic view of society. Lately in 1975, Preston and Post (cited in Key, 1999) created a model based on acknowledgement of societal actors for whom the firm is responsible.

The notion of stakeholder in the Information System domain has always been present, at least in its simplest form of participants in the project: users,

developers and managers (Pouloudi & Whitley, 1997). However, this approach has been proved often insufficient to reflect and gather all the complexity on how IS affects and is affected by organisations (Lyytinen & Hirschheim, 1987).

In the next section the use of the stakeholder concept in the IS domain is presented.

2.5.2 Stakeholder theory in the IS context

Stakeholder concept is by definition a more complex concept than users, developers and managers. Those actors are directly involved in the design, development and implementation of an information system. Whereas stakeholder are also those whose actions can influence or be influenced by the system in someway. They can be any individual, group, organisation or institution who can affect or be affected by the system (Papazafeiropoulou *et al.* 2005). This definition reflects better the complexity of the networks and individuals in Information Systems in which more than one organisation is involved (inter-organisational systems). However, most of the time, the use of stakeholder has been narrowed to those three -users, managers and developers.

Several academic authors have proposed a wider use of stakeholder in the information systems domain. Gupta (1995) proposed the use of stakeholder analysis for inter-organisational systems. Zhang *et al.* (2005) suggested the use of stakeholder analysis to reflect the benefits and barriers of the adoption of e-government. Vos and Achterkamp (2006) suggested a classification model for identification of stakeholders in innovation projects. Serafeimidis and Smithson (1999) emphasized the importance of taking into consideration stakeholder analysis in the evaluation of information system investment. Fairchild *et al.* (2004) proposes to consider stakeholder context and expectation in the definition of a success factor model for electronic commerce. These researches have proposed the use of stakeholder theories in one way or another to provide a better understanding of the role, expectation and inter-relationships of stakeholders in any information systems and in any life cycle stage.

Critiques of stakeholder are based on the limited importance paid to the context in which stakeholders interact; inadequate explanation of process itself, incomplete linkage of internal and external variables and insufficient attention to the system within which business operates and the levels of analysis within the system (Key, 1999). Thus, stakeholder analysis can be improved by complementing it with other frameworks or approaches, which could reflect some of the mentioned limitations. Indeed, the stakeholder concept has been complemented with some socio-technical approaches. Examples of that are: Actor-Network theories (Atkinson *et al., 2001*), Soft development approach (Atkinson *et al.* 2002), discrete modelling simulation (Eldabi, *et al.* 2002) among others. These examples are developed further in the following section.

2.5.3 Stakeholder on health information systems

The academic literature about the stakeholder concept in the healthcare information systems has been commonly limited to principal stakeholders, such as doctors, nurses and administrators or managers and also often to just one organisation. This approach, however, is insufficient and does not reflect the complexity of the e-Health networks, in which, there are a significant number of actors involved from different organisations or groups. Indeed, in e-Health systems, patients and their families or carers are the main users of the system, and most of the time without having participated in the design of it. Additionally nurses, doctors and other health-related professional are equally users, with different needs and perceptions. Moreover, managers can belong to different healthcare organisations, because most e-health systems try to join in the same network different health-related organisations, such as, hospitals, primary care, secondary care, etc.

The need for gathering information of key stakeholders in the healthcare information systems area have been extensively recognised in the academic literature (Pouloudi & Whitley , 1997; Lyons *et al.*, 2005). However, most of the time their identification remains limited to the most obvious ones and do not follow a structural process (Pouloudi & Whitley, 1997; Vos & Achterkamp, 2006; Mantzana, *et al.*, 2007).

An example of this limitation was presented by Pouloudi (1998) in healthcare information systems related to drug management. In this research a framework to identify stakeholder was defined. The framework was based on several principles (Fig.2.3), which helped to identify who were the main groups and individuals who could affect or be affected by the system under study.

Atkinson *et al.* (2001) added an insight to the topic from the Actor-Network theory (Latour, 1987; Callon, 1991;), in which not only human actors or stakeholders are considered but also non-human actors. Both of them, human and non-human are symmetrically considered. This research explored and developed the synergies between The Soft Information Systems and Technologies Methodology (SISTeM), Participative Simulation Modelling and Stakeholder Analysis. All these frameworks and approaches are based on the socio-technical nature of health information systems. This work was developed further by Atkinson *et al.* (2002) paying attention to several aspects and in particular to telemedicine. Stakeholder analysis was also used in the work of Eldabi *et al.* (2002) in his research about healthcare modelling and integrating stakeholder analysis to represent the complex healthcare systems, which involve multiple decision-makers. This research showed the importance of considering a wide spectrum of stakeholders in the health technology context and the value of stakeholder identification joined with other socio-technical approaches.

Other uses of stakeholder theories are the work of Dansky & Gamm (2004). This paper presented a conceptual model to reflect the interest of four key stakeholders: physicians, patients, insurance companies or managed care organisations and government officials or entities in telehealth programs. This paper however, limited the use of stakeholder to just four groups: a restricted representation of the stakeholders of such programs. Jones *et al.* (2005), identified 12 different groups of professional stakeholders to study the research agenda for e-Health in the UK. In this case the number of stakeholders is significant and the identification was done by an iterative process, working with a preliminary list who were asked to identify new interest participants.

Stakeholder analysis and in particular a framework for an accurate identification of stakeholders, can add great value to other socio-technical approaches or be considered as a preliminary stage for addressing further issues, such as research agenda, evaluation process, simulation and adoption. The healthcare area involve by nature multiple interest groups and a formal identification of those groups can improve the understanding of human and social issues for all the stakeholders involved in the adoption of such systems. The identification of stakeholders could be improved significantly using an iterative process, in which obvious stakeholders identify other not so obvious stakeholders. Pouloudi and Whitley's framework (1997) for stakeholders identification is particularly suitable, because it addresses a set of principles, such as the identification of new stakeholders through the previously identified, the interlinks among them and the need for reflecting the context in which it is produced (Fig.2.3).

Principles of Stakeholder Behaviour	Implications for Stakeholder identification and analysis
– The set and number of stakeholders are context and time dependent – Stakeholders cannot be viewed in isolation – A stakeholder's role may change over time – Stakeholders may have different roles – Different stakeholders may have different perspectives and wishes – The viewpoints and wishes of stakeholders may change over time. – Stakeholders may be unable to serve their interests or realise their wishes.	– Stakeholders map should reflect the context – Stakeholders map should be review over time – Consider how stakeholders are linked – Adopt a long-term perspective: study how perceptions change – There are different versions of stakeholders map to be drawn – These different versions should be reviewed over time – Need to consider political issues (as well as technical, economic, etc.)

Table 2.14 Principles to identify stakeholders Pouloudi & Whitley (1998).

The principal focus of this framework is the identification of stakeholders and validation of their perceptions in complex information systems. Thus, used in combination with SCOT, this can add a formal approach and enrich the initial stages of SCOT, in which the interest groups are identified.

2.6 Summary

In this chapter the relevant academic literature has been presented and critically reviewed. Firstly, the area of e-Health has been presented, paying particular attention to the telecare area and information systems oriented to support chronically ill patients. The main conclusions that arise are that the area is underdeveloped and adoption is still scarce. However, it is generally accepted their potential for cost-reduction and improving the quality of life of those patients. Previous research about benefits and barriers and review papers in the area were examined. The limited consensus apart from the most common factors could be observed. The theoretical foundations of this thesis, SCOT, and Stakeholder theories are then explored. The combination of both approaches is discussed and critically reviewed. They can reinforce each other and facilitate a formal framework to identify benefits and barriers for e-Health adoption.

3 Chapter 3. Research methods

3.1 Introduction

Research methods have evolved in the last decades from a narrow focus, basically technical to a broader approach in which the multidisciplinary nature of information systems is taken into account (Avison & Myers, 2002). In particular, in the healthcare arena, the need to use a research approach, which acknowledges not only technical but human and organisational aspects is even clearer. Integrated and multidisciplinary approaches have demonstrated to provide a better insight into healthcare Information Systems (Aarts & Berg, 2004).

In this chapter the research strategy is presented and justified. Firstly, a general introduction of the qualitative research methods is presented. Afterwards, the research method chosen and its appropriateness are discussed. The following section presents the context in which this research has been conducted: the UK and Spanish healthcare systems. Finally, the data collection and the data analysis strategies are explained. The aim of this chapter is to justify the chosen approach and to present the context and details of the case studies.

3.2 Qualitative research Methods

The most common way of classifying research methods is between qualitative and quantitative methods. The roots of quantitative methods are in the natural sciences and are based on quantifying and measuring what is observed and collected by the researcher (Myers, 1997). Ideally, the researcher is placed outside the research and does not interfere with the experiment. Typical research methods are surveys, laboratory experiments, mathematical modelling and, especially relevant for this context randomised controlled trials. Randomised control trials have been largely used in the healthcare arena and are considered one of the most appropriate and scientific methods of research for the majority of

the medical community. However, qualitative studies are becoming more popular in the healthcare context (Murphy *et al*. 1998).

On the other hand, qualitative research methods have their roots in social sciences and aim to research and understand information systems as a whole within the organisation and the social network in which it is produced. A qualitative approach pays particular attention to the social influences over technology. Rather than trying to quantify what occurs they try to understand the phenomenon and the context in which it exists (Avison & Myers, 2002). Case studies, action research and grounded theory, among others, are typical qualitative research methods, in which the researcher may or may not be part of the research itself.

3.2.1 Philosophical perspectives

Qualitative and quantitative research has an underlying philosophical perspective, which guides the research. Epistemology is the science of how knowledge is obtained and understood. However, in practice these philosophical distinctions have blurred limits. According to Myers (1997) there are three epistemologies: Positivist, interpretive and critical.

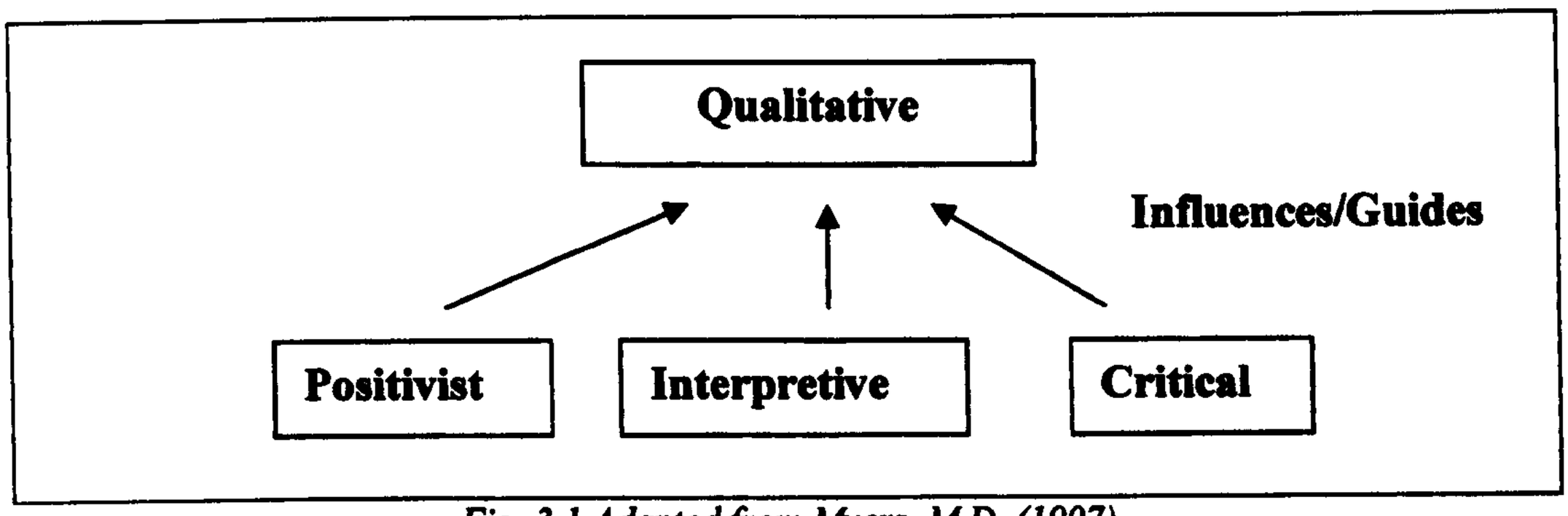

Fig. 3.1 Adapted from Myers, M.D. (1997)

The aim of positivism is to make reliable predictions and explanations. The researcher, normally, tries to reduce the field of investigation, focusing on one specific area. Positivist assumes that reality is objectively given and can have measurable properties.

Interpretive approaches try to gain understanding of the phenomena in the context in which it is produced and through the different perceptions of the people or groups involved. The basic assumption is that reality is socially constructed and shaped by the groups and individuals' perceptions. Information systems cannot be seen as isolated systems, but as a part of a whole. This approach has long roots, and goes back to the first Greek philosophers: Socrates, Plato and Aristotle. For instance, Plato (1997) in the "Myth of the cave" explains how people can just see the shadow of the reality rather than the reality itself. From these shadows, they constructed their own reality, quite different from the reality of those that could observed the cave from another perspective. What people perceived then is constructed by their own circumstances and experience. Consequently there is not a universal reality but several perceptions of the same. The unique way of trying to represent this reality is through the understanding and representation of the diversity of perceptions of all the people and groups involved. This philosophical stream of opinion is based on relativism. The most critical view of relativism is based on considering perception as reality, thus there is not a unique reality, but as many as different perceptions.

Critical epistemology is based on the assumption that social reality is historically produced and perception of people is constrained by social, cultural and political dominations. The researcher has an active part in the research, hence she/he participates and decides. The focus is on conflicts, contradictions and oppositions that are common in the contemporary world.

Qualitative research methods can have any of those epistemologies: positivism, interpretive and critical and this will lead the way to how knowledge and data are acquired and how they are analysed. However, the limits of those philosophies are often blurred and some characteristics can be shared for more than one approach.

3.3 Research approach

This dissertation is a qualitative research and the method used has been the case study. The underlying epistemology is interpretive because the aim has been to

understand the phenomenon through the social groups and individuals or stakeholders involved in the system. Our construction of reality is shaped by the interpretation of reality done by human actors (Walsham, 1995, 2006). As Walsham (2002) highlighted the motivation has been to create an initial theoretical framework based on previous knowledge (Stakeholder theories and Social Construction of Technology).

Case study is commonly used in IS research and fits particularly well in this context (Cavaye, 1996; Yin, 2003; Walsham, 1995, 2006), where the focus is on contemporary events and several organisations are involved (Benbasat *et al.*, 2002). However, case study can be researched in many different ways (Cavaye, 1996) according to the philosophical perspectives mentioned before, critical, interpretive or positivist. It makes this method very versatile and consequently very flexible to adapt to different research needs.

There is not a unique definition of case study. According to Benbasat *et al.* (2002) compilation of previous work, case study investigates the information system within its context, gathering data from multiple sources and from one or more stakeholders. Additionally they resume the eleven more relevant characteristics of case studies (Table 3.1)

1. Phenomenon is examined in a natural setting
2. Data are collected by multiples means
3. One or few entities (person, group, organisation) are examined.
4. The complexity of the unit is studied intensively.
5. Case studies are more suitable for the exploration, classification and hypothesis development stages of the knowledge building process; the investigator should have a receptive attitude towards exploration.
6. No experimental controls or manipulation are involved.
7. The investigator may not specify the set of independent and dependent variables in advance.
8. The results derived depend heavily on the integrative powers of the investigator.
9. Changes in site selection and data collection methods could take place as the investigator develops new hypotheses.
10. Case research is useful for study of "why" and "how" questions because these deal with operational links to be traced over time rather than with frequency or incidence.
11. The focus is on contemporary events.

Table 3.1 Key characteristics of case studies (Benbasat et al. 2002)

Following the characteristics showed in table 3.1, case study election was justified due to the following reasons. The aim of this dissertation is to produce a framework to represent benefits and barriers of telemedicine based on the stakeholders' perceptions and their implications for adoption. Case study is chosen because it would help to understand the process and the context as a whole. The context in which this project was conducted: healthcare systems, was as relevant as the information system itself. The system could not be understood without taking into consideration the organisations in which it exists: hospitals, primary care centres, patients' homes, and the interaction of the different stakeholders.

According to the last characteristic mentioned in table 3.1, case study is particularly useful in contemporary events. Telemedicine, and in particular those systems oriented to support chronically ill patients or telecare, are a relatively new area. Although the first systems arrived one decade ago, it is still in a very emergent period and the normal use of them is underdeveloped.

Furthermore, the data was collected by multiple means and studied intensively: Open-ended interviews to the majority of stakeholders, for up to two hours, questionnaires for patients, observation of the system while being used, examination of documents and texts, and thorough attendance to several training sessions for patients.

According to the seventh characteristic of table 3.1, there were no previously defined variables, but they were identified once the data was analysed using content analysis as the analytical tool for data analysis.

However, case study can also present some limitations (Yin, 2003). These limitations are inherent to the method itself; hence try to minimise their impact is a challenge.

1. The difficulty of doing scientific generalising from results. However, the purpose of this thesis was not to generalise from the findings, creating a

general theory but a conceptual framework that could be used in different contexts with different outcomes.

2. Lack of rigour of case studies. Research bias is an integral part of interpretive research. In this research the researcher's opinion was not imposed on the participants as they were given the express their opinions by responding to a number of open questions on the same subject. Though, it is impossible not to influence the participants in some degree, because just by formulating questions your own opinions may be presupposed. On the other hand, it can be argued that the engagement might provide a better access to the project and the participants. Moreover, it might provide a more reflexive interpretation of the results (Nandhakumar & Jones, 1997).
3. The confusion between case study teachings in which the data are deliberately altered for teaching purposes and case study research. In this case the result was not a teaching case study but a research case study.
4. It often takes a long time and makes it complex to analyse the great amount of documents and texts. However the length of time dedicated to a thesis makes it possible to conduct this type of research successfully.

In order to understand the case studies in its context, in the following section Spanish and UK healthcare systems are presented with their similarities and their differences.

3.4 Research context.

This research has been conducted in Spain and the UK. In the UK, a pilot project based on a telemedicine system to connect residential nursing homes with health professionals and in Spain, a telecare system oriented to support chronically ill patients at home. The main reason for choosing a transnational research was to minimise the effects of two different healthcare contexts in the outcomes.

Both health systems are of public provision of healthcare, where Governments and Health authorities set overall policies and frameworks and where services are provided mainly by public agencies or agreed private organisations. Both

systems are also funded by taxes. Healthcare is free and is provided by a complex network of primary and community centres, secondary hospitals and tertiary services, regardless of whether they were publicly owned or not. Although desirable, there is in fact a certain lack of integration among different health providers.

Even though the UK and the Spanish health system are essentially similar, some differences can be observed, with the General Practitioner (GP) in the UK playing a more significant role of coordination among different health services than in Spain. For a better interpretation of the stages in the evolution of a chronic disease, the figure 3.2 has been created. It should be noted however, that the evolution of a chronic condition could not be always linear.

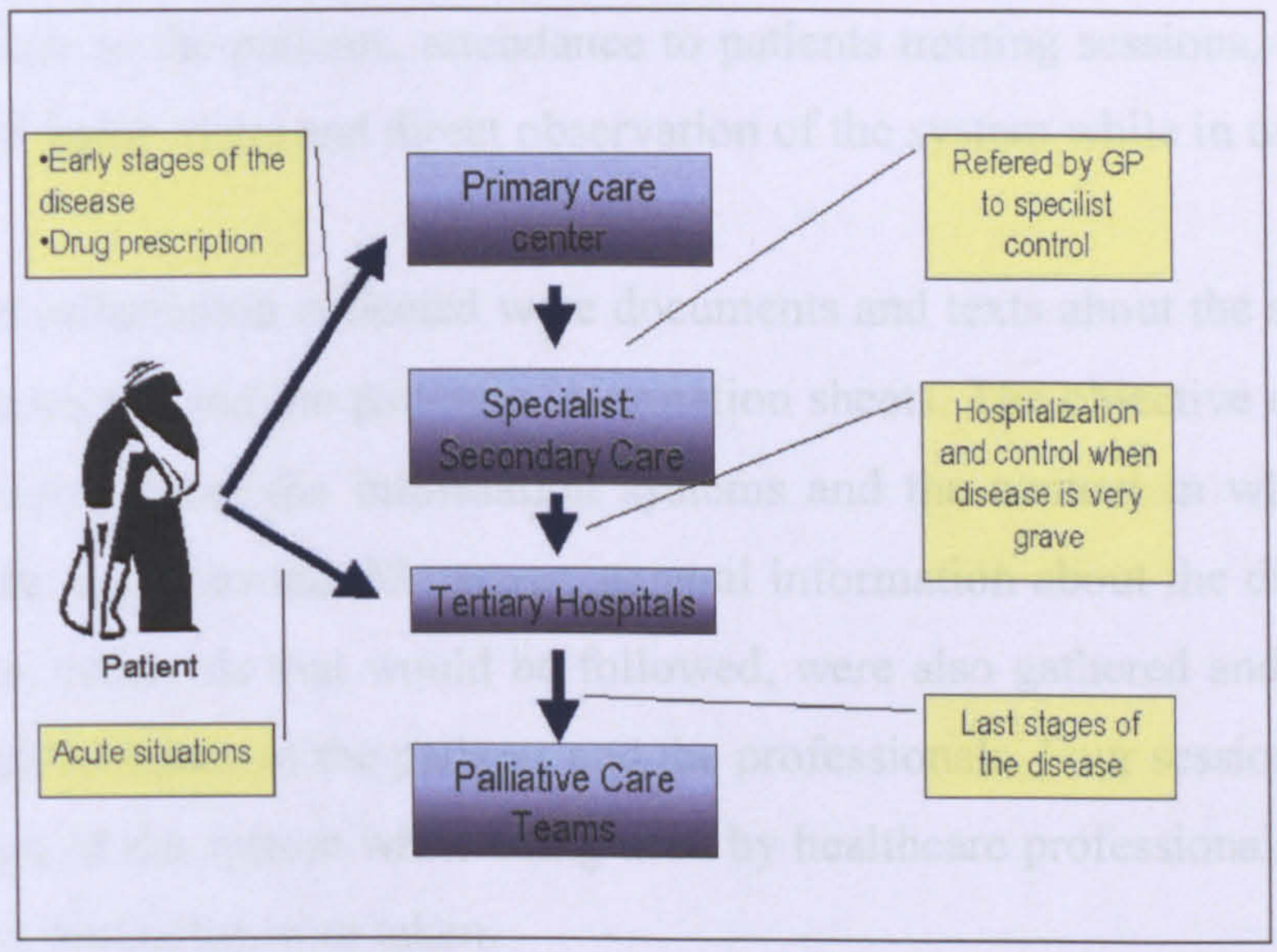

Fig. 3.2 Evolution of chronic conditions

According to the WHO (2002) most of the healthcare systems share similar characteristics in the chronic condition care system, and the Spanish and UK are not an exception: (i) They are organised to provide acute illness care, rather than chronic care. Care is fragmented and focused on acute and emergent symptoms. (ii) The role of the patient is not emphasized and self-management is not promoted (iii) Follow up is sporadic, and normally not until their symptoms become intolerable. (iv) Community services tend to be ignored. Healthcare systems often tend to pay little attention to any programs from outside the same

system, like patient associations, non-governmental organisations and consumers groups. (v) Prevention is under-utilised. Although most chronic conditions are preventable, prevention programs are far from the routine clinical care. In this context, the WHO (2002) proposes a framework for "innovative care for chronic conditions" based on the linkage of all the stakeholders involved, further discussion of the model is presented in Chapter 2 section 2.2

3.5 Data collection strategy

The data of the UK case study, a telecare system for chronic patients in a residential setting, and the Spanish case study, a telecare systems for chronic patients at home, were collected using several sources: semi-structured interviews with the participants, study of document and text about the system, questionnaire to the patients, attendance to patients training sessions, attendance to patients' home visits and direct observation of the system while in use.

The initial information collected were documents and texts about the system, the clinical protocols and the patient's information sheets. The objective of this data was to inform about the information systems and the context in which it was going to be implemented. Moreover, general information about the diseases and the clinical protocols that would be followed, were also gathered and studied to understand the needs of the patients and the professionals. Four sessions of direct observation of the system while being used by healthcare professionals were also conducted, and notes were taken.

Additionally, three patients training sessions were attended by the researcher, in which the case managers trained the patients in how to use the system, assessed them on the difficulties they could have while using it on their own and trained them in how to take the medication and the clinical aspect of the disease. Those sessions provided valuable information about the real difficulties of the patients with the system, their attitude towards the system and how the case manager and nurses interact with the patients and their families.

Three visits to patients' homes were conducted with a specialist nurse. The visits were done after an alarm from the system. When the system reported an alarm about a particular patient, the protocol was to first contact the patient by telephone and deliver the appropriate response: a visit from a specialist nurse, a doctor or send the patient directly to an emergency room. In those visits, the researcher observed the protocol and the reactions of patients, families and professionals and took notes on it.

The principal sources of data were semi-structured open-ended interviews with the stakeholders involved in the cases. The interviews were conducted in their offices and lasted from 45 minutes up to two hours. They were recorded using a digital recording machine, except for two cases in which the individuals refused to be recorded. In these cases notes were taken during the interviews. Later, those interviews were manually transcribed for the purpose of doing data analysis.

The interviewees were selected depending on their involvement in the area and according to the stakeholder framework, one of the questions was to identify other stakeholders that could be also involved. A first contact was conducted by telephone or e-mail, explaining the research and asking for his/her willingness to participate.

A total of 46 interviews were conducted to 21 different groups of stakeholders, during an 8 month period. For the exploratory case study I, 6 interviews were conducted, and for the case study II, 40 (see table 3.2 and 3.3). However, from the 40 interviews of case II, 8 of them were discarded due to the lack of connection with the project under study, such as the one of the case manager, who was not yet participating in the project at the moment of the interview.

Stakeholder group	Number of interviewees	Discarded interviewees
Case Manager	1	1
Project Leader	1	
Hospital Specialist Doctors	2	
Specialist Nurse	3	1
Call-centre assistant	1	
Hospital Managers	1	
Medical Director	1	

Primary care doctors-GP	1	
Primary care nurses		1
Social Workers		1
Patients (plus questionnaire to 65)	5	
Families of patients	2	
IS managers	1	3
ERP systems managers	1	
Hospital Researchers	1	1
University Researchers	3	
Clinical Technicians	1	
Regional health authorities	1	
IT technicians	1	
Ethical committee managers	1	
Industry (Telecommunication)	2	
Industry (Mobile phones)	1	
Home healthcare teams	1	
TOTAL.....	**32**	**8**

Table 3.2 Detail of interviews in the Case study II

Stakeholder group	**Number of interviewees**	**Discarded Interviewees**
Primary care doctors	2	
Nurses	1	
Patients	1	
Researchers	1	
TOTAL.....	**5**	**0**

Table 3.3 Detail of interviews in the Case study I

Although initially the research plan was to gather the information of the patients in semi-structured interviews, in reality it was difficult to get this information because of the great number of patients involved, -70-, the difficulties of getting access to all of them and, most importantly trying to avoid biasing them. They commonly identified researchers with healthcare professionals and their opinions during the interview were influenced by this fact. Consequently, a questionnaire was prepared to try to gather their opinions and perceptions. The questionnaire had 6 general questions about the patient, and a list of possible benefits and problems that could arise from the participation in the project. Finally two open questions were asked about other benefits or problems (see Appendix B). The list of benefits and barriers were gathered through the meta-analysis conducted (see Chapter 2, section 2.3), which compiled previous studies, and the results obtained through the direct interviews to five patients.

3.6 Strategy for the data analysis

Data collection and data analysis in qualitative research has not followed a clear waterfall model, but an ongoing process in which the data collection strategies are enriched with the previous analysis of this data (Avison & Myers, 2002).

There are numerous ways of conducting the analysis of data, (whether verbal or written), such as hermeneutics, content analysis, semiotics, narrative and metaphor, etc. However, in practice those ways of analysis have multiple overlaps and an increasing number of researchers are approaching the analysis in a more pragmatic way (Miles & Huberman 1994). Indeed, there is a stream of opinion which argues that there is not such a large difference between positivism or interpretivism research (Weber, 2004).

For this dissertation, a combined approach to analysis has been taken, combining hermeneutics as philosophical background and content analysis as the analytical tool. Relational content analysis has been chosen as the analytical technique to reduce, display and draw conclusions from the data. Hermeneutics has been used to make sense of the research in their context, and to try to understand the whole and their parts or the contexts and each participant perception as interrelated. In particular in information systems, the concept of hermeneutic circle is related to making sense of the incomplete and confused perceptions of the different stakeholders and the relationship among people, organisation and information technology. It suggests that the meaning can only be found within its context (Klein & Myers, 1999).

The three steps followed in the data analysis were: Data reduction, data display and conclusion drawing/verification. (Miles & Huberman, 1994) (See fig. 3.3).

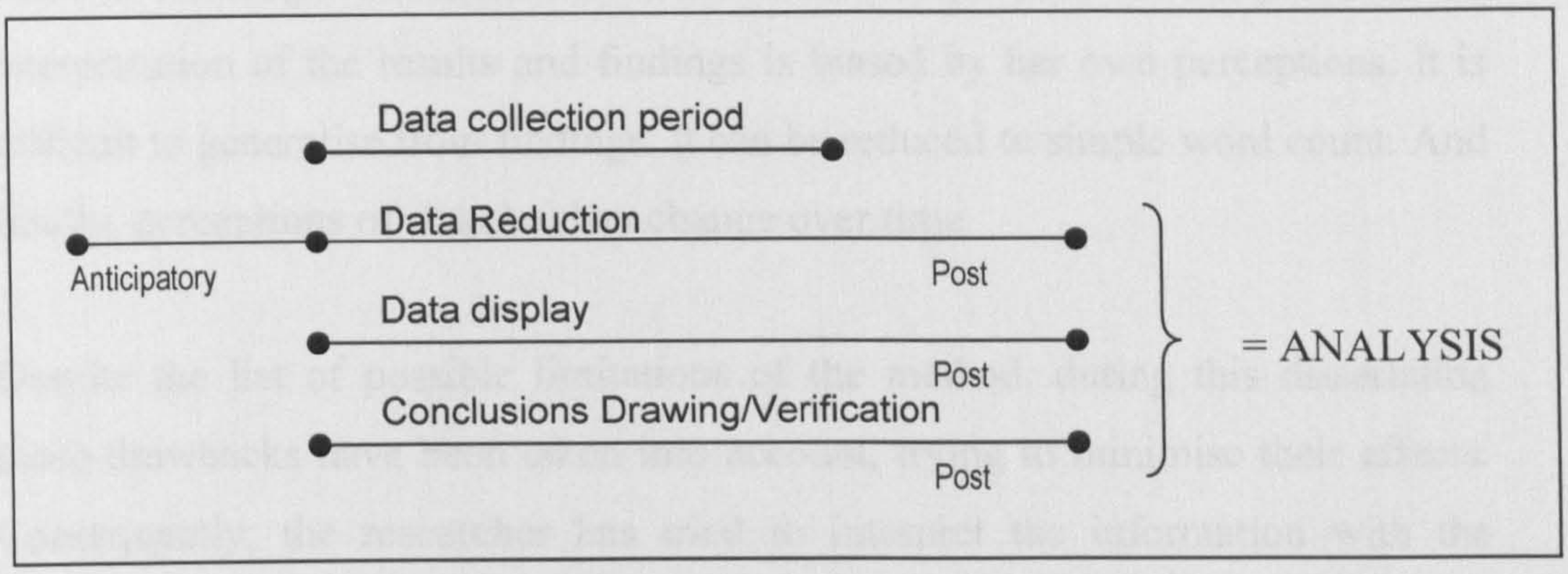

Fig. 3.3 Flow Model of Data Analysis (Miles & Huberman, 1994)

These three activities happened at the same time, and also partially during the data collection period. According to Miles & Huberman (1994) these three activities are: Data reduction attempts to organise, discard, sharp and sort the data, hence conclusions can be drawn. Data display is related to organising the data in tables and displays. Conclusion drawing/verification is the process of extracting meaning from the data, noting patterns, regularities and how the data flows.

The process followed in this dissertation is summarised in figure 3.4. Firstly once all data was transcribed, the texts were analysed and common themes and concepts were identified. A second step was to interpret the data into their context and to establish the relationship among them. Each group of stakeholders offered a partial view of the whole picture. A third stage was to display and organise the information in tables and matrixes, which could help to draw conclusions and verifications. The final stage was to present the conclusions and findings.

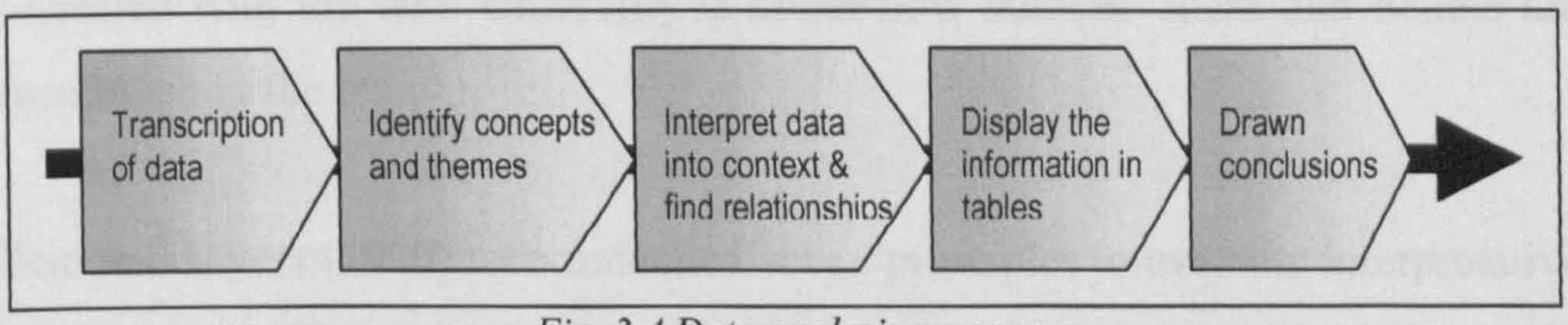

Fig. 3.4 Data analysis process

However, qualitative data analysis has several drawbacks: It is particularly time consuming. It is highly dependent on the researcher's background and own

context. Although the researcher tries to be independent of the process, her interpretation of the results and findings is biased by her own perceptions. It is difficult to generalise from findings. It can be reduced to simple word count. And finally, perceptions of stakeholders change over time.

Despite the list of possible limitations of the method, during this dissertation those drawbacks have been taken into account, trying to minimise their effects. Consequently, the researcher has tried to interpret the information with the maximum rigour, trying to limit her own opinions. Additionally the purpose was not to formulate a general theory, but to find and test a framework that could be used in other contexts. Word count has been avoided while conducting the analysis. Finally, stakeholders' perceptions have been checked formulating different questions about the same, to minimise the impact of possible changes and aiming to reflect their perception as accurate as possible.

3.7 Methods for evaluation

Evaluating the validity and quality of qualitative research is almost as important as the research itself. There is not a straightforward process in evaluation; however, some methods or principles have been suggested (Golden-Biddle & Locke, 1993, Klein & Myers, 1999; Mays & Pope, 2000).

Golden-Biddle and Locke, (1993) as cited in Walsham (2006) set three principles: authenticity, plausibility and criticality. Authenticity is concerned with showing that effectively the authors have been there. Plausibility tries to reflect how well the personal and professional experiences of the reader are connected with the text. Criticality is about how authors' ideas and beliefs are represented in the text.

Klein and Myers (1999) recommended seven principles to evaluate interpretative field research. Those principles were based on the study of anthropology, the philosophy of phenomenology and hermeneutics. The seven principles were: the fundamental principle of hermeneutics circle, the principle of contextualization, the principle of interaction between the researchers and the subjects; the principle

of abstraction and generalisation; the principle of dialogical reasoning; the principle of multiple interpretations and the principle of suspicion.

However, those methods were more focused on the methodological appropriateness, than in the validity of the results from the research. A research project can fulfil those methods and still not produce valid results (Walsham, 2006). For this reason the method suggested by Mays and Pope (2000) has been chosen in this dissertation, in an attempt to validate the research from a perspective that could reflect not only methodology but outcomes as well.

According to Mays and Pope (2000) there are several ways to assess the validity: triangulation, respondent validation, clear exposition of methods of data collection and analysis, reflexivity, attention to negative cases and fair dealing. Triangulation is the process of comparing results from different sources. The purpose of triangulation is to highlight convergence, complementary and divergence. Hence, it would contribute in enhancing the validity of the research, increasing the likelihood of findings and interpreting the differences (Farmer, *et al.* 2006). According to Murphy *et al.* (1998) there are four types of triangulation: data, method, investigator and theoretical triangulation. Data triangulation is when data from different sources is used to research the same phenomenon. Method triangulation when different research methods are employed. Investigator triangulation when different investigators research the same phenomenon. Theoretical triangulation when different theoretical models are used. According to Miles & Hubberman (1994) discordant findings can be constructive because they may lead to meaningful understanding.

Clear exposition of methods and data collection and analysis, serve to justify how the process of analysis of data has produced the research outcomes. (Mays & Pope, 2000). Qualitative research is based on the interpretation by the researcher, thus a clear description of the process might support the results.

Attention to negative cases is related to explaining the data that could be contradictory with the rest of the outcomes, whereas, fair dealing is related to incorporating the perspectives and perception of different stakeholders. Hence,

the viewpoint of one group is not the only represented (Mays & Pope, 2000). Both these methods have been applied through out the whole research process: the first one by paying particular attention to the discordant opinions, and the second one by representing the opinions of all stakeholders.

The evaluation of the effectiveness of the framework has been conducted by paying particular attention to clear exhibition of methods and theoretical comparison with their precursors. For the evaluation of the findings, data triangulation has been chosen. This evaluation is presented in chapter 6.

3.8 Summary

This chapter has dealt with the research approach of this dissertation. A brief introduction of the qualitative methods has been presented, paying particular attention to case study methodology and the interpretivist approach. The next section presents the context in which this research has been conducted, the UK and Spain healthcare systems; both systems are of public provision of healthcare, free and universal for the whole population. Additionally, the integrated healthcare system proposed by WHO (2002) is explained. This model can be better supported by the adoption of e-Health systems. All these facilitate the understanding of the findings as a hermeneutical circle, inherently related to its context. The data collection strategy is afterwards presented. Interviews, questionnaires, attendance to training sessions, visits to patients' home, observation of the system while being used and documents and texts about the project are sources of data collection for both case studies. Finally, the data analysis strategy –content analysis and hermeneutics- is presented.

4 Chapter 4. The proposed framework

4.1 Introduction

The first objective of this chapter is to present the proposed framework to assess the benefits and barriers of e-health applications. This framework is based on social construction of technology and stakeholder theories and it was defined using the literature review of the area. The second objective is to conduct an exploratory case study to validate the proposed framework with real data. The framework is applied to the case study and the outcomes are presented afterwards in section 4.3. The case study was conducted in the UK and aimed to investigate the use of remote patient monitoring. In addition, this case study was also conducted to refine the research strategy and to obtain a preliminary list of stakeholders.

4.2 The rationale behind the new framework

The aim of this new framework is to identify the benefits and barriers of the adoption of e-health systems for all the stakeholders involved. The proposed framework will help to acknowledge the potential problematic areas for the implementation and adoption of e-Health systems for each actor or social group. Hence, it would offer solutions based on the potential benefits for each of them.

This framework will be based on the SCOT model and the stakeholder identification framework. This new framework aims to enrich some areas of SCOT that show improvement potential. The first area is the identification of Stakeholders or social groups involved. Using Pouloudi and Whitley's framework will strengthen the SCOT framework, which does not provide a systematic model to identify social groups.

The second area of improvement is related to the identification of the benefits for each social group. SCOT pays very little attention to identify what the expected benefits for each social group are and what the opportunities are that can arise

from it. This research advocates that adding benefits and opportunities to the model will reinforce it and provide new ways of stabilization and closure.

4.3 The proposed framework

The new Benefits and Barriers framework (BEBAF) is represented in figure 4.1. As mentioned before, this new framework is based on the SCOT model and stakeholder theories.

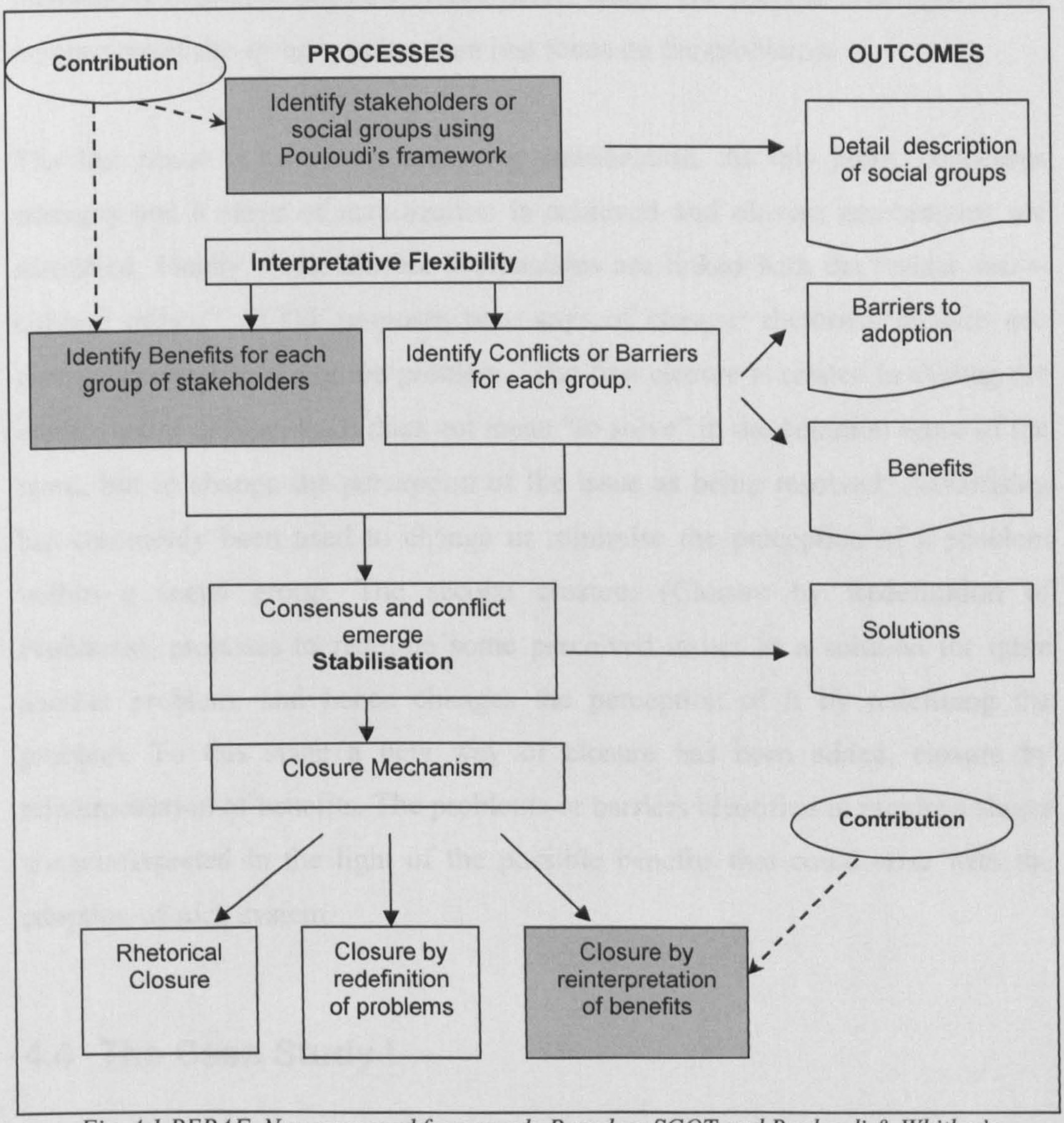

Fig. 4.1 BEBAF. New proposed framework. Based on SCOT and Pouloudi & Whitley's framework

The first stage of the framework is to identify the social groups or stakeholders involved in the systems. For this purpose, Pouloudi and Whitley's framework is

suggested as an interactive model to identify obvious and not so obvious groups or individuals who can affect or be affected by a particular information system.

The second phase proposed is the Interpretative flexibility. In this stage there is not a clear consensus about the technology. Several barriers or conflicts emerge and are interpreted in a different way. Consequently, different solutions emerge to resolve each problem. Those conflicts could even clash among the different groups and at this stage it is difficult to find a consensus. Identification of benefits for each group is added to this stage as a way of finding and identifying the positive effects of this new system under study. The purpose is to open a new perspective to the system, rather than just focus on the problems.

The last phase is based on achieving stabilization. At this point, consensus emerges and a stage of stabilization is achieved and closure mechanisms are identified. Finally, those closure mechanisms are linked with the "wider socio-cultural milieu". SCOT proposes two ways of closure: rhetorical closure and closure by redefinition of the problem. The first closure is related to closing the controversies or barriers. It does not mean "to solve" in the common sense of the word, but to change the perception of the issue as being resolved. Advertising has commonly been used to change or minimise the perception of a problem within a social group. The second closure: (Closure by Redefinition of Problems), proposes to redefine some perceived issues as a solution for quite another problem, and hence changes the perception of it by redefining the problem. To this stage a new way of closure has been added, closure by reinterpretation of benefits. The problems or barriers identified in previous stages are reinterpreted in the light of the possible benefits that could arise with the adoption of such system.

4.4 The Case Study I

4.4.1 Description of the case study

The exploratory case study was part of the E-vital project in UK. E-Vital was a European Community founded project aiming to validate the use of remote

patient monitoring (RPM) to patients at home or in a residential setting. For this purpose, telemonitors able to measure multiple parameters including electrocardiogram (7-lead ECG), blood pressure, oxygen saturation (SpO_2), heart rate, temperature and respiration were set up in one high dependency nursing home and two residential care homes. The telemonitor was a wireless device specifically developed for this project that transmitted the data securely over the Internet (Bratan, *et al.* 2005; Bratan, *et al.* 2007). The target patients were chronic patients and patients discharged early from hospital after an intervention. The system has several components: the patient module was the monitoring device. The patient or the nurse, following the care protocol created by the medical doctor, took the measurements and automatically they were sent to the server. Another component was the e-Vital server, here the healthcare professional could personalise the protocols and check the health situation of each patient. In case of any measurement out of limits or a warning situation, the system raised an alarm that was sent to the doctor and to the patient as well. The network architecture is presented in figure 4.2.

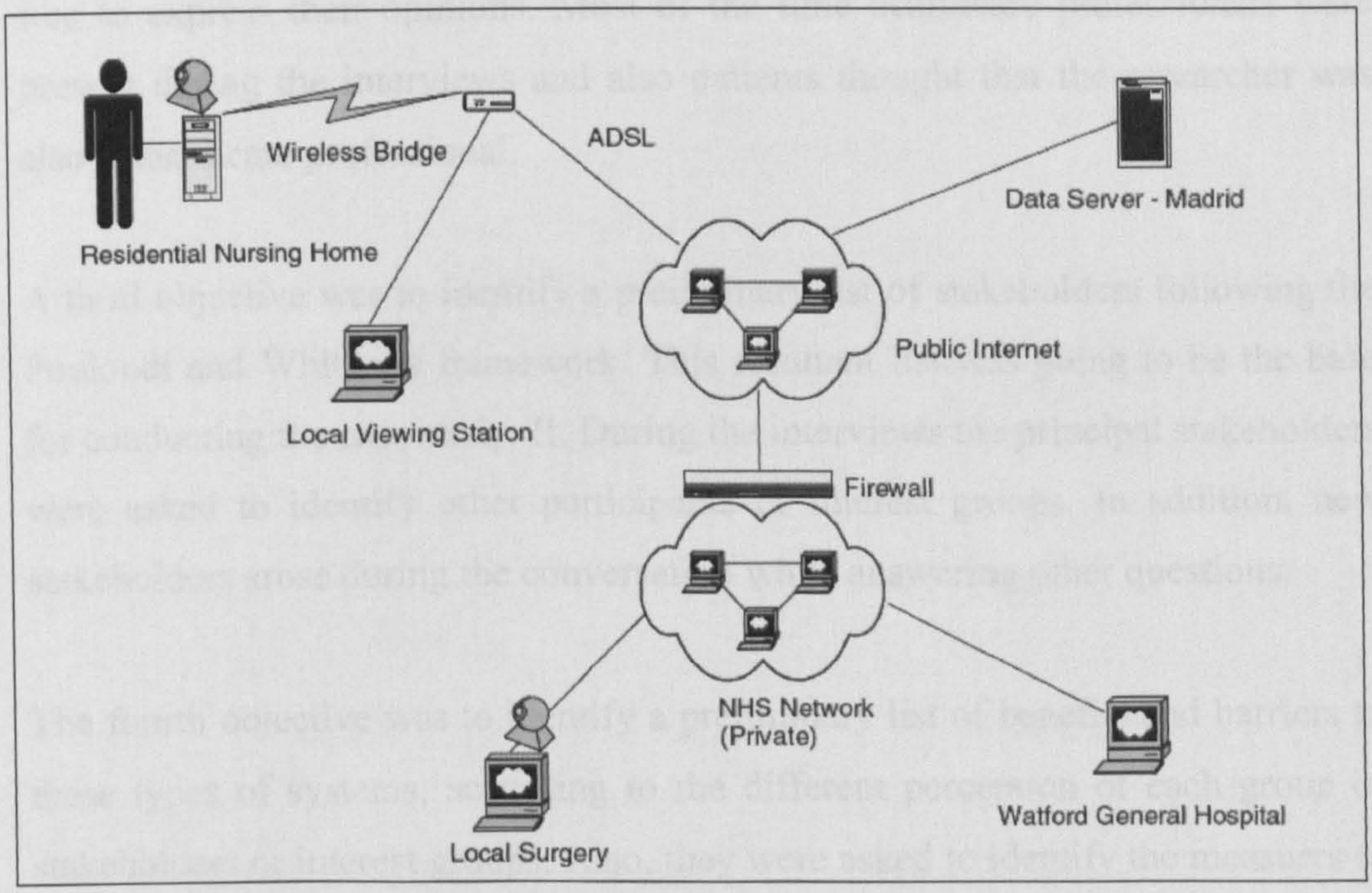

Fig. 4.2 Network architecture. Adapted from Bratan et al. (2005)

In case of a health concern of any of the residents, the tele-monitor was connected by carers or nurses and vital signal measured. The data was transmitted securely over the Internet to a data server and the responsible health

professional was contacted. Once the health professional had accessed the data and evaluated the situation, he/she contacted the home to advise on the proper action to take; which could include, immediate admission to hospital, a doctor's visit, clinical intervention, change of medication or observation.

4.4.2 The rationale behind the case study

The objective of performing an exploratory case study was first to test the research aim in a real context. For this purpose a project, which was already implemented, was selected and investigated.

The second objective was to refine the research strategy. The initial interviews to relevant stakeholders helped to refine the questions and to include new ones, hence they could be better understood by any of the possible participants. Also, the duration of the interviews was set up at this stage. In addition, the questionnaire to patients was decided and defined due to the difficulty of having access to all the patients involved and also the fact that patients would not feel free to express their opinions. Most of the time healthcare professionals were present during the interviews and also patients thought that the researcher was also a healthcare professional.

A third objective was to identify a preliminary list of stakeholders following the Pouloudi and Whitley's framework. This resultant list was going to be the base for conducting the case study. II. During the interviews the principal stakeholders were asked to identify other participants or interest groups. In addition, new stakeholders arose during the conversation while answering other questions.

The fourth objective was to identify a preliminary list of benefits and barriers to these types of systems, according to the different perception of each group of stakeholders or interest groups. Also, they were asked to identify the measures to improve the adoption of e-Health systems.

Finally, the main objective was to test the proposed framework with the outcomes from this case study. As introduced previously, this research advocates

the need for a new framework which can help to assess the benefits and barriers of e-health adoption.

4.5 Application of BEBAF to the case study I

In this section, BEBAF is applied following the scheme presented in section 4.3. First, the stakeholders are identified, followed by the list of benefits and barriers to those types of systems. Then the graphical representation of each stage of the framework are presented and the outcomes are critically discussed.

4.5.1 The preliminary list of stakeholders:

One of the objectives of this research was to identify a preliminary list of stakeholders following the Pouloudi and Whitley's framework. The identified stakeholder will be used in the case study II as a starter list (see table 4.1).

Original Stakeholder	Identified Stakeholders
Primary care doctors (General Practitioner)	Universities research teams NHS central Primary care trust Social services Residential home inspectors District nurses
Nurses	Physiotherapist Relatives Managers
Patients	Relatives
Researchers	Medical centre managers Ethical approval committees

Table 4.1 Identified stakeholders

Firstly, following the proposed framework (BEBAF), the principal stakeholders were identified, namely: Primary care doctors, nurses, patients and researchers. In order to identify the rest of stakeholders, they were asked to identify other interest groups, individuals or organisations involved in the system. Additionally, other stakeholders arose during the conversation. The results are shown in the table 4.1: in the right hand column the groups of stakeholders interviewed, and in the left hand column the rest of the stakeholders identified. Some of the stakeholders identified were mentioned by more than one from the preliminary list; to avoid duplications, repeated stakeholders have been omitted.

4.5.2 Primary care doctors

This group is responsible for primary care healthcare services. In this case, patients were directly followed by this group of physicians. Traditionally they have not been fully involved in research projects. Their normal and regular routines frequently overload their dedication and, as a consequence, promoting research from their position becomes considerably difficult. However, other groups of stakeholders seem to perceive them as key and with a pivotal role within the integrated care model.

4.5.3 Nurses

Nurses have a pivotal role in those types of systems. In this case they were responsible for the following up of patients and also for taking the measures of the vital signals of the patient with the telemonitor. Additionally, they were the first in case of an alarm and the link between patients and other healthcare professionals.

4.5.4 Families and patients

This group of stakeholders is the centre of the system; patients and families have a significant role as direct users of the system, uncommon in other health information systems. The patients selected for this trial were chronic patients or patients discharged early from hospital from 60 to 85 years old. One of the objectives of the system was to educate and empower patients in order to improve their self-management skills.

4.5.5 University research teams

In this project a university research team was involved in the research project as designers of some of the solutions and as evaluator of the project. This research team has been involved in several telemedicine projects for hospitals. This type of collaboration between healthcare organisations, such as hospitals, and technical universities is quite common and useful to provide a different approach

to research activities, especially to those related to technology, due to the different skills set that these teams provide.

4.5.6 The Benefits reported.

In order to identify their perception about the benefits and barriers that the selected tele-care system would have for them and for other groups, different questions were asked to the stakeholders (see Appendix A). The answers were codified in themes or common concepts following content analysis. Once themes were identified, they were classified in several categories: professional, clinical, patient-related, organisational and economic benefits. These categories arose from the analysis of the data in order to simplify and clarify the study. It is worth noting that some of those benefits could be classified in more than one category. In such cases, the benefit has been classified in the category in which it had more relevance. For instance, reduce hospital admissions and hospitalisation, can be considered a patient-related benefit, an organisational benefit because it implies a better use of scarce resources, or a clinical benefit because it results in a better evolution of the clinical aspects. This last classification has been considered the one which is more relevant and direct, while the others are the result of this reduction in hospitalisation.

Professional benefits were related to the improvement and development of professional healthcare work. Clinical benefits were related to the clinical aspects of the diseases. Organisational benefits were related to the organisational structures and the work procedures. Patient-related benefits were those benefits related to the improvement in patients' condition and perception. Finally, economic benefits were those related to the control of costs and funding opportunities. The results are shown in table 4.2., the first column shows the category, the second one who reported the issue, the third one the number of stakeholders who mentioned it, and the fourth one the benefit.

Categories	Who reported	Nº	Benefits
Clinical	GP Nurses Research Groups	3	Early diagnosis - reduce deterioration and allow better evolution

Clinical	GP Nurses Research Groups	3	Reduce hospital admissions & hospitalisations
Clinical	GP	1	Help with diagnosis decisions
Clinical	Nurses	1	Access to new technology; better follow up of the patients.
Professional	GP Nurses	2	Empower the role of primary care teams.
Professional	GP	1	GP and nurses have access to new knowledge.
Professional	GP	1	Make the work more interesting
Professional	GP	1	Building better relationships with healthcare professionals from different levels
Organisational	Patients GP	2	Increase medical care in distant places
Organisational	GP	1	Better transferring of information about a disease to specialist.
Organisational	GP	1	Flatter the relationship among health professionals.
Economic	Health authorities	1	Potentially save money to health authorities
Patient-related	GP Research groups	2	Improve patients' care, quality of life and satisfaction.
Patient-related	GP	1	Enrich the community and improve the social support
Patient-related	Nurses	1	Patients get more confident about their treatment & the healthcare professionals
Patient-related	Nurses	1	Gain confidence with the relatives

Table 4.2 Benefits reported

The clinical benefits were the group of benefits most reported by different stakeholders. Reduce hospitalisation and facilitate earlier diagnosis are relevant driving forces of those systems. It will lead to cost reduction in healthcare intervention. Home care costs tend to be lower than hospital healthcare costs. Also, better evolution can be expected too, avoiding in some degree deterioration and acute complications.

The other benefit that was mentioned by the two groups of healthcare professionals, -general practitioners and nurses- was the possibility of empowering the professional role of the primary care teams. Their role is pivotal and they often have most of the responsibility in the follow-up of the patients. Other professional benefits mentioned were intrinsically related to this one, such us increasing their knowledge about disease, making their daily work more interesting and flattering the relationship among professionals.

4.5.7 The barriers reported

The same strategy was used to identify the barriers or problems for the adoption of those systems. Several questions were asked to the stakeholders (see appendix A) and the results were identified, classified and finally analysed (Table 4.3). The difference with the classification of benefits is that another category emerged: Technical barriers. Those barriers were related to the technology itself and the difficulties that could emerge from its use. An example of this new category is the technical problems with the system.

The majority of barriers mentioned are related to professional issues and likely related to the context of the case at this stage, most of the work is voluntary, not paid and performed during overtime.

Categories	Who reported	Nº	Barriers
Clinical	Research Group GP	2	It is not yet proved and makes it difficult to work with something that may or may not work. Benefits have been very marginal
Clinical	GP	1	Lack of uniformity about protocols in different hospitals.
Economic	Research Group GP Nurses	3	Problems with funding. Cost of set up
Economic	GP	1	There is lack of cost-effectiveness studies
Economic	GP	1	Drug companies do not invest in this type of systems yet. (Traditional investors)
Economic	Research Group	1	Health authorities are more interested in funding pilot projects, than actually funding just to do it.
Organisational	GP Nurses Research Groups	3	Difficulties to make compatible virtual consultation and normal routine. New activities are done in overtime.
Organisational	GP Nurses	2	Lack of training of healthcare professionals in the new skills needed to do this work.
Organisational	GP Nurses	2	Change in the role of patients. Patients need to be properly trained to do monitoring and to avoid resistance
Organisational	Nurses	1	Lack of support from managers
Organisational	GP Research Groups	2	Slowness of health authorities, such as primary care trust and NH. Lack of support
Organisational	GP	1	Lack of awareness of Health authorities about the complexity of the system, they would prefer a kit in a box
Organisational	Nurses	1	Need to reorganise the work. What happens if there is an alarm in the middle of the night
Organisational	GP	1	Inspections from health authorities make it difficult to make pilot projects.
Organisational	GP Nurses Research Groups	3	Difficulties with the authorizations for research in the area

Professional	GP Nurses Research Groups	3	Difficulties to make it part of normal activities. Most of the work is done in overtime.
Professional	Nurses Research Groups	2	Lack of awareness in healthcare professionals
Professional	GP	1	Worries about ownership.
Professional	Nurses	1	Unclear decision process: Need to get used to a different way of working.
Professionals	GP	1	Power factors and hierarchical barriers between healthcare professionals.
Professionals	GP	1	Loss of enthusiasm due to the difficulties found to start working
Professional	GP	1	More involvement of Healthcare professionals in the design of the systems.
Professional	GP	1	Danger that it could be technology driven rather than citizen services driven.
Technical	GP	1	Concerns about data privacy
Technical	GP Nurses Research Groups	3	Technology is having problems (they are not commercial solutions, they are more prototypes)
Technical	Nurses	1	Problems with hard copies. Lack of trust on the technology.

Table 4.3 Barriers reported

Technology is still an issue, probably because most of the projects use prototypes rather than commercial solutions. Consequently, healthcare professionals find it difficult to trust in the technology while the systems are not reliable enough.

From an economic perspective, the main barrier is the cost and the difficulty of finding appropriate funding to carry out the project. The traditional way of funding in the healthcare arena is drug companies, which, excluding some exceptions, do not participate very actively in this type of project at this stage. It makes it even more necessary for an official support from healthcare authorities.

Organisational issues are also related to the need for reorganising clinical work in order to effectively take advantage of those systems. Healthcare work tends to be very independent and fragmented; this is a characteristic that clashes with the intrinsic philosophy of integrated healthcare work.

The main clinical barrier reported was the limited demonstrated evidence of the benefits of telecare systems. This benefit is directly related to the lack of sufficient studies that support the benefits that can arise from their application.

Hence, professionals find it difficult to trust in a new technology that could or could not work. In addition, the difficulty of using uniform clinical protocols or "care protocols" for all the healthcare stakeholders involved.

The outcomes of this case study show a list of potential benefits for the adoption of those systems and potential barriers for it. However, in order to understand its implications in the adoption the graphical representation of the framework would add a better insight.

4.6 Graphical representation of BEBAF to the case study

In this section the graphic representation of the framework for the case study I is presented. Based on SCOT symbols, a new symbol was needed to represent the benefits (Fig. 4.3). Adding to the graphical representation the benefits helped to realise the potential of the system and to discover new ways of closure by reinterpretation of benefits. Additionally, two different types of lines have been applied. Continue line represents the ownership relation between stakeholder and benefit or barrier. Dotted line represents the link between benefit, barrier and possible solution.

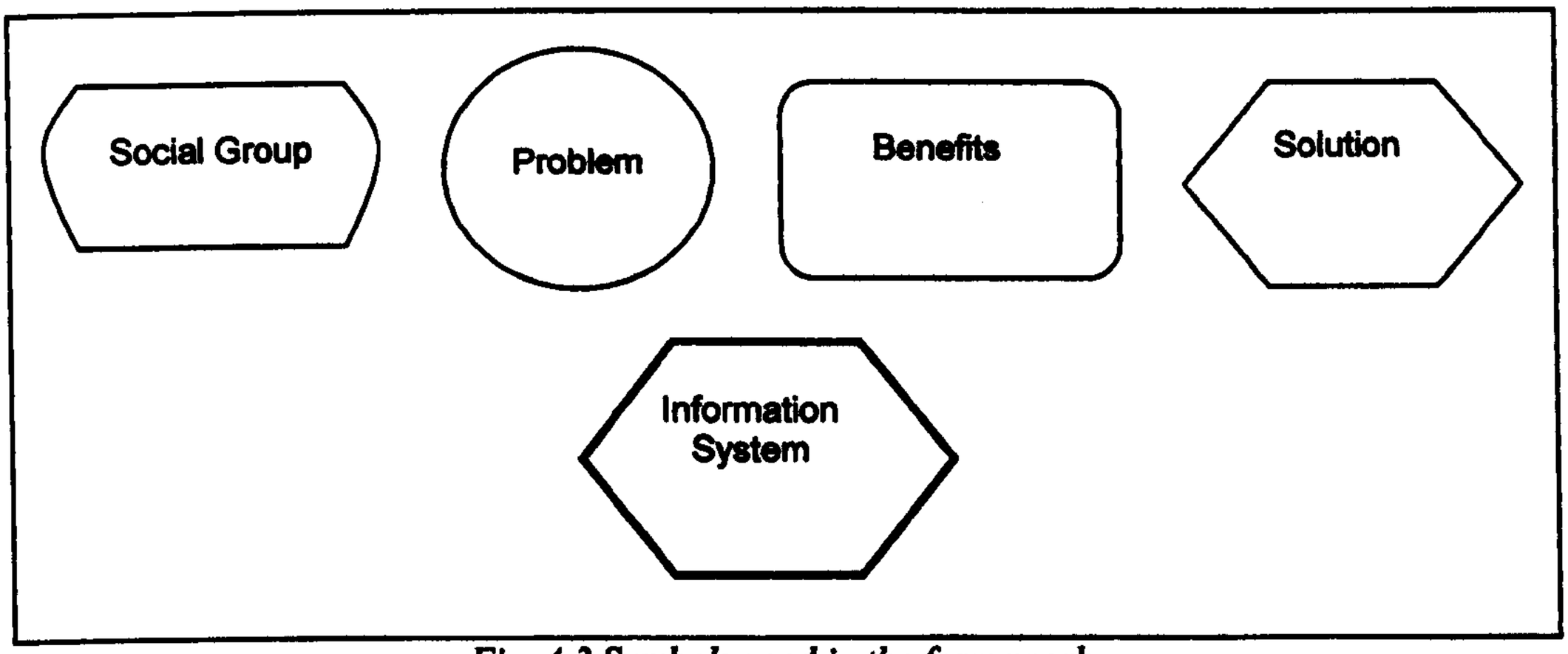

Fig. 4.3 Symbols used in the framework

In this graphic representation, the 'artefact' in our case Information System is represented firstly with all the social groups or stakeholders that are involved in the system (Fig. 4.4). The main stakeholders are represented in bold letters and the other ones identified using the framework are in italic letters.

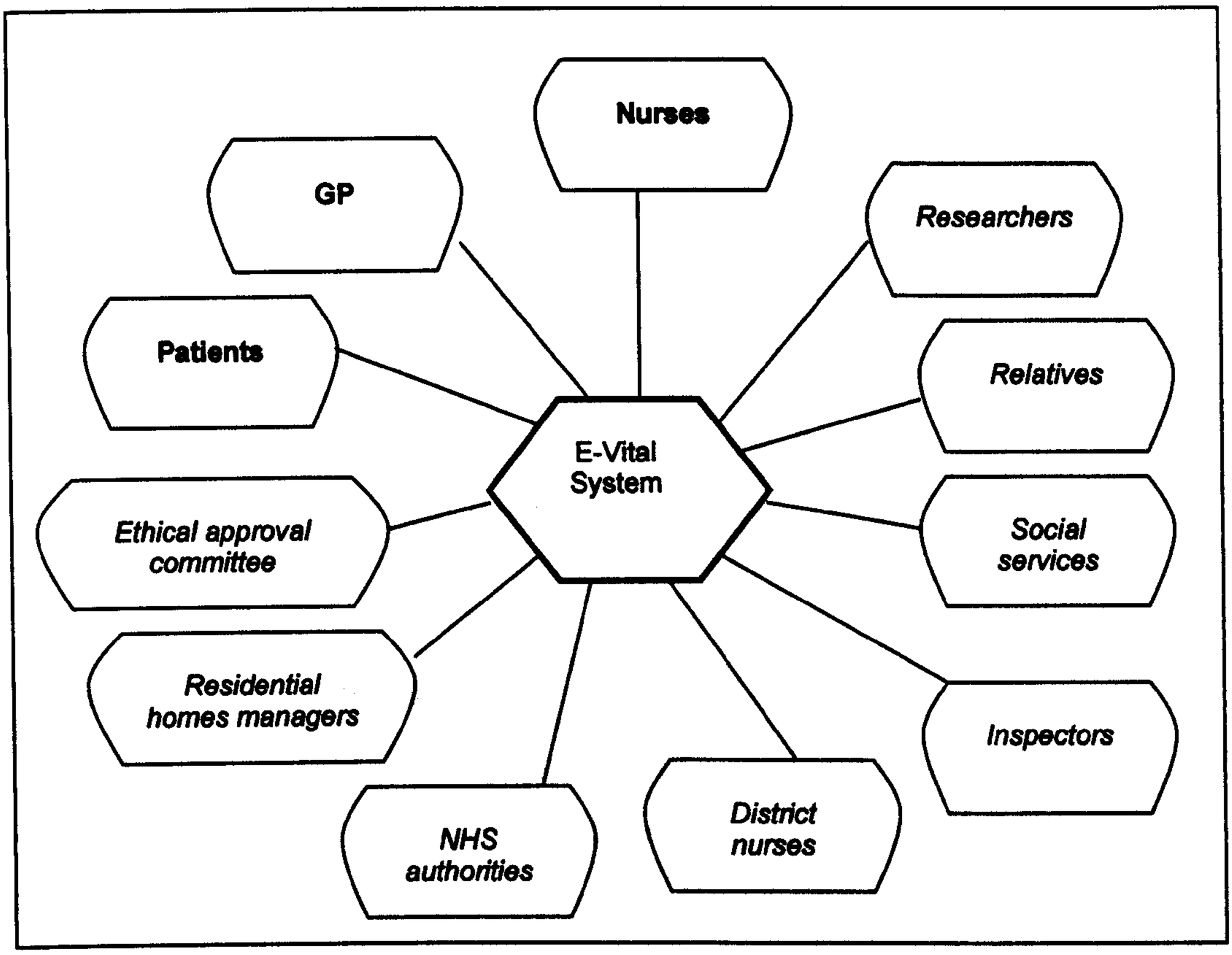

Fig. 4.4 The relationship between the "artefact" and the stakeholders involved.

4.6.1 Economic issues

Two main barriers arise related to economic issues: difficulty of access to funding and not proven cost-effectiveness. Although they are different, they are however interrelated. The difficulty of access to proper funding, mainly through NHS projects or EU projects makes it difficult to prove the potential cost-effectiveness with a sufficient number of studies. In fact, potential savings through reduction in clinical interventions, visits to emergency rooms and hospital admissions can justify the investment in telecare projects from the economic perspective.

As a solution, the two barriers can be reinterpreted through the potential benefit of reducing cost in clinical interventions to healthcare system. As far as cost-effectiveness could be proven the main barriers would be resolved and more funding would be available for those projects.

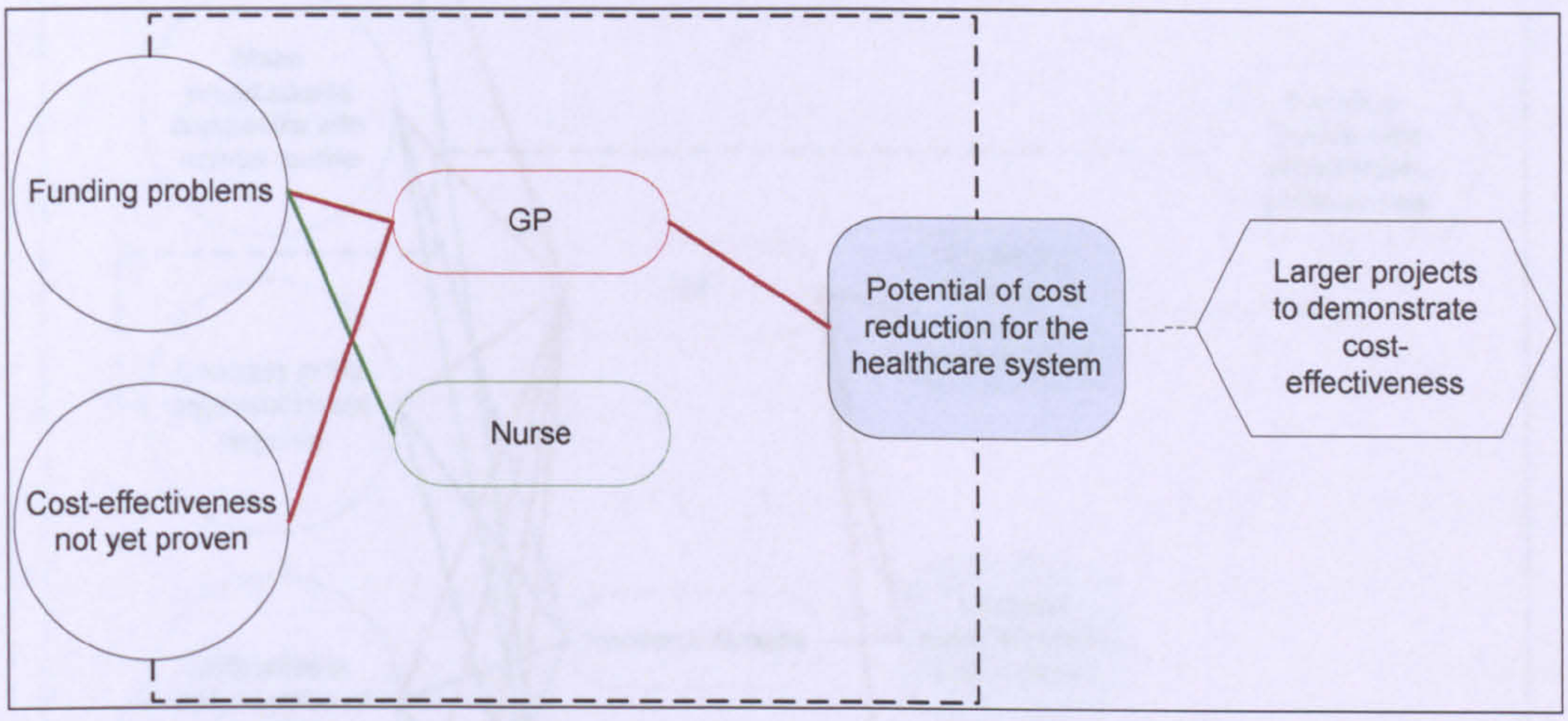

Fig. 4.5 Framework applied to economic issues

4.6.2 Organisational issues

Organisational issues were strongly related to the need for a change in the organisation that could make compatible normal routine work with this new way of medical care. At this stage, the lack of support from managers and the way they are funded, through research projects, configured the way those systems are perceived apart from medical routine. This implies that most of the work is done out of the normal working hours and by voluntary work. As mentioned before, those systems are meaningful in integrated care systems in which different health providers work in collaboration. Unfortunately this is far away from the reality of the UK health system, more based on acute support than in prevention.

Another barrier reported is the difficulty of getting authorisation for projects. In the UK, to get the COREC (Central Office for Research Ethics Committees) authorisation is a long and challenging process. It makes the research process slower and adds an additional difficulty and rigidity.

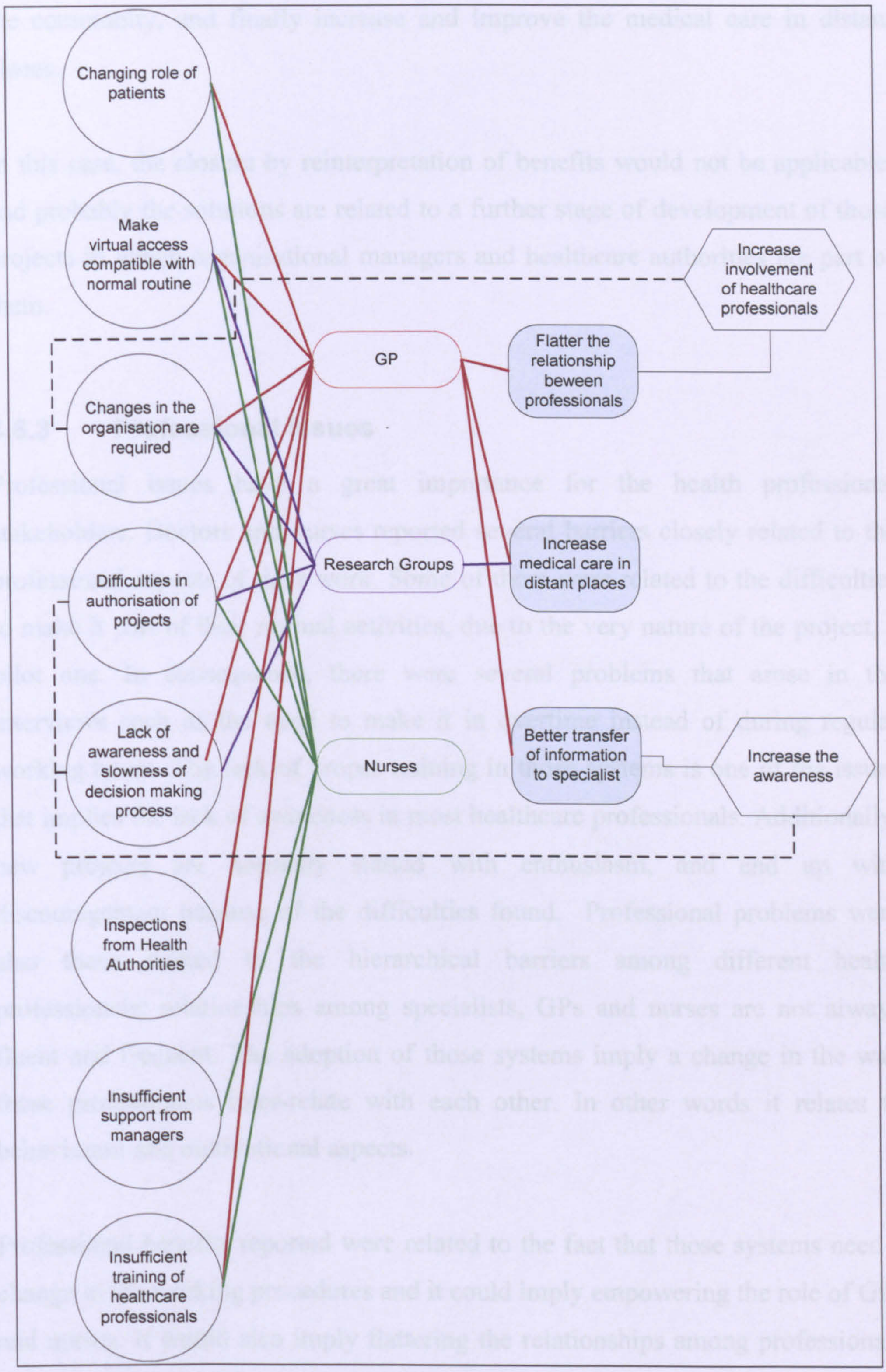

Fig. 4.6 Organisational Issues

The organisational benefits reported were: improve the transfer of information among health providers, praise from patients and at the same time enrichment of

the community, and finally increase and improve the medical care in distant places.

In this case, the closure by reinterpretation of benefits would not be applicable, and probably the solutions are related to a further stage of development of those projects in which organisational managers and healthcare authorities are part of them.

4.6.3 Professional issues

Professional issues have a great importance for the health professional stakeholders. Doctors and nurses reported several barriers closely related to the professional aspects of their work. Some of them were related to the difficulties to make it part of their normal activities, due to the very nature of the project, a pilot one. In consequence, there were several problems that arose in the interviews such as the need to make it in overtime instead of during regular working hours. The lack of proper training in those systems is one of the issues that implies the lack of awareness in most healthcare professionals. Additionally, new projects are normally started with enthusiasm, and end up with discouragement because of the difficulties found. Professional problems were also those related to the hierarchical barriers among different health professionals; relationships among specialists, GPs and nurses are not always fluent and frequent. The adoption of those systems imply a change in the way those professionals inter-relate with each other. In other words it relates to behavioural and motivational aspects.

Professional benefits reported were related to the fact that those systems need a change in the working procedures and it could imply empowering the role of GPs and nurses. It would also imply flattering the relationships among professionals allowing them to build a better workflow with specialists and consequently gain access to new knowledge. It could also contribute in making jobs more interesting and challenging. Additionally gaining confidence with relatives and patients was also reported as a benefit. In summary, the benefits reported provide a new way of understanding the health professionals networking. It can be

considered a way of achieving the closure of those barriers by the reinterpretation of benefits.

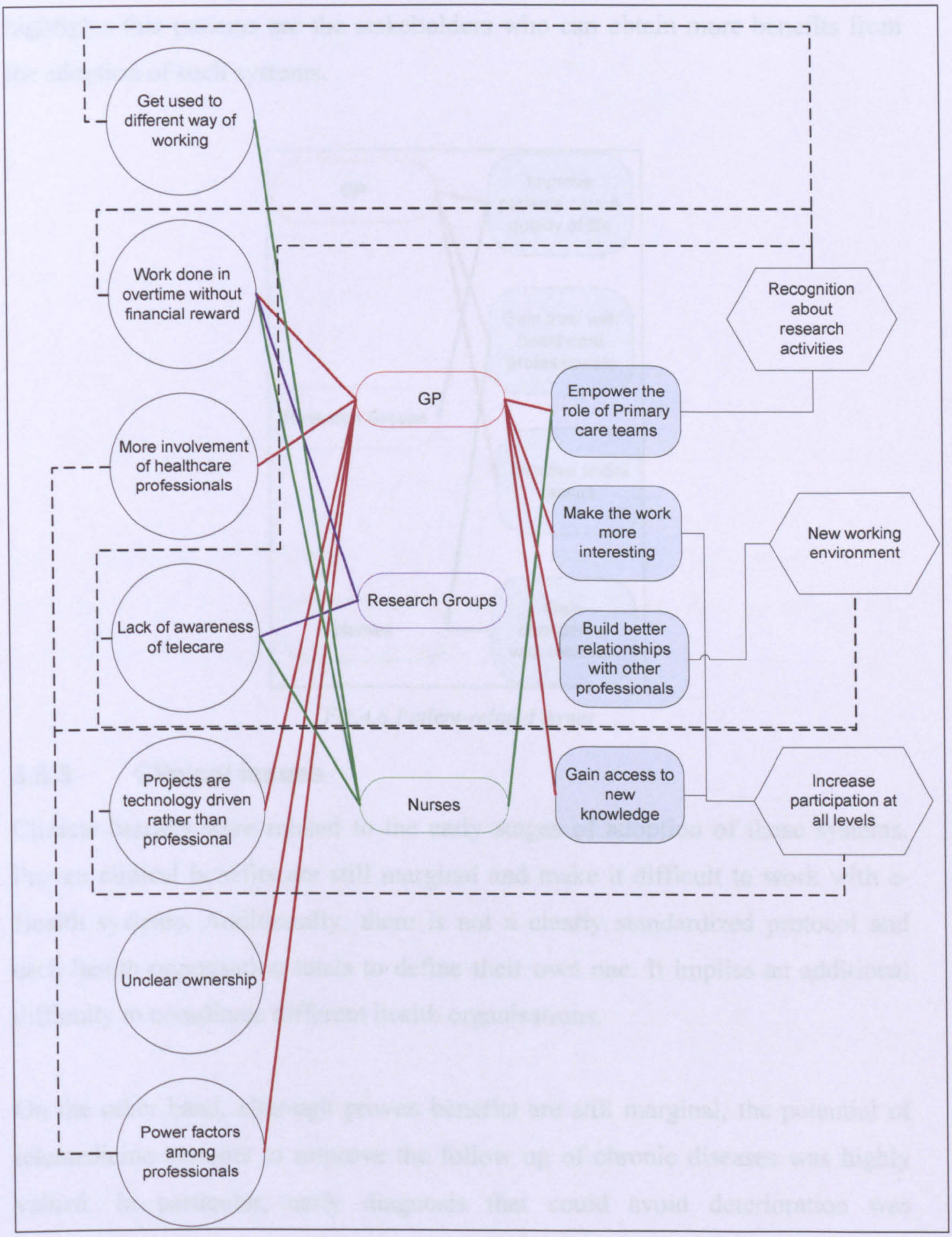

Fig. 4.7 Professional issues

4.6.4 Patient-related issues

Patient-related issues were those related directly to the perception and benefits that patients could get. They were the only category without reported barriers. It highlights that patients are the stakeholders who can obtain more benefits from the adoption of such systems.

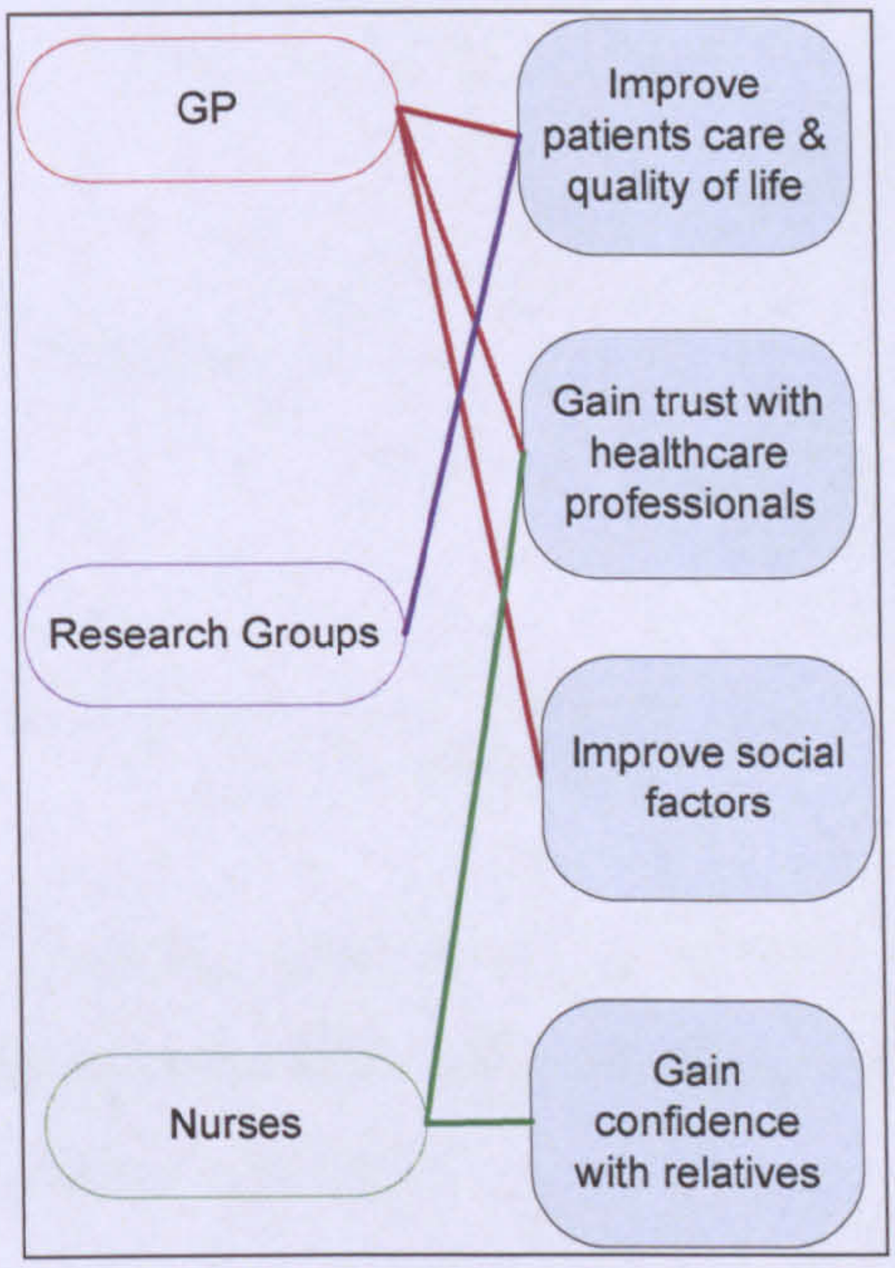

Fig.4.8 Patient-related issues

4.6.5 Clinical issues

Clinical barriers were related to the early stages of adoption of those systems. Proven clinical benefits are still marginal and make it difficult to work with e-Health systems. Additionally, there is not a clearly standardized protocol and each health organisation tends to define their own one. It implies an additional difficulty to coordinate different health organisations.

On the other hand, although proven benefits are still marginal, the potential of telemedicine systems to improve the follow up of chronic diseases was highly valued. In particular, early diagnosis that could avoid deterioration was mentioned. Also its potential to support diagnostic decisions, reduce hospital admissions and a better follow up of the disease were mentioned as benefits.

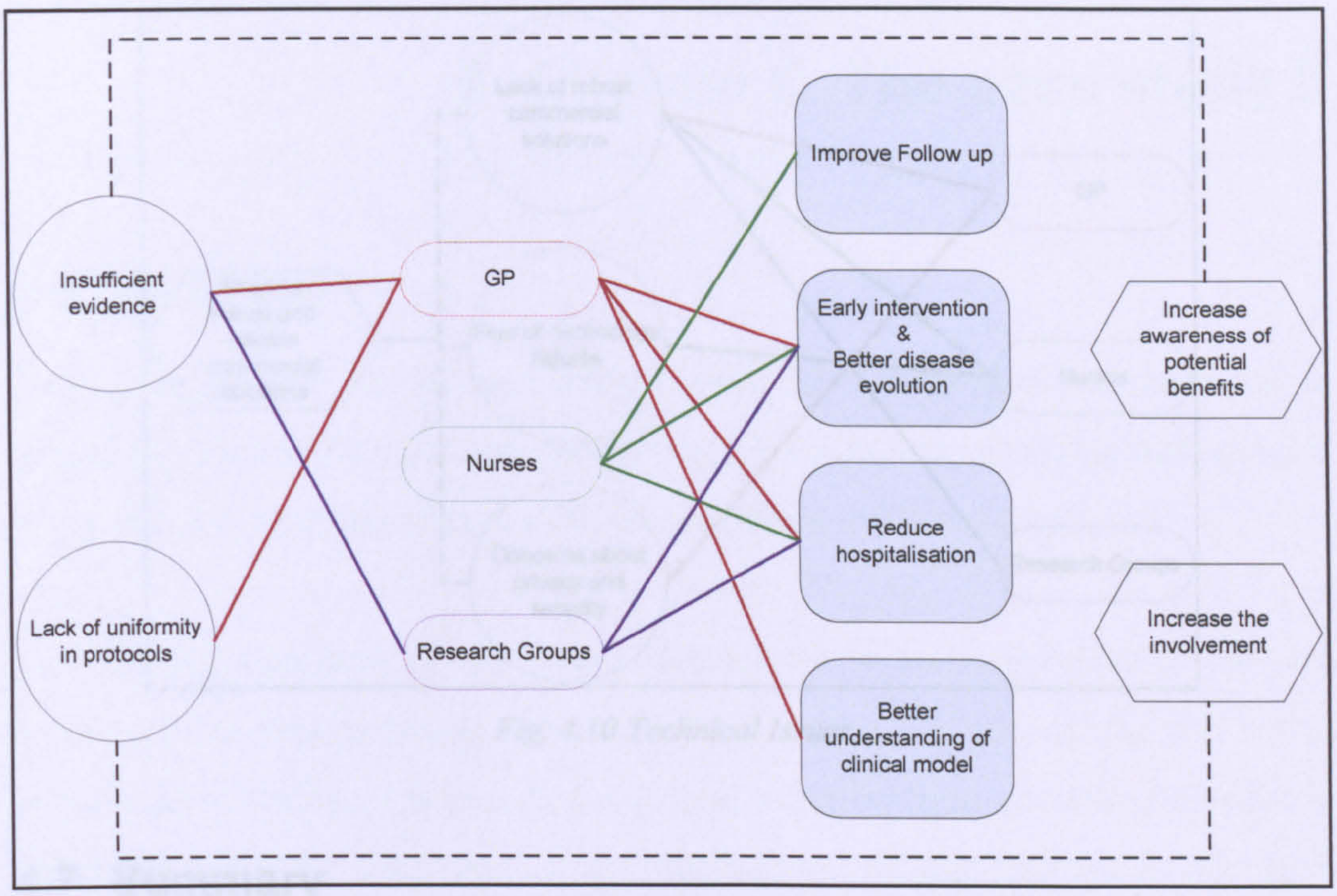

Fig. 4.9 Clinical Issues

The solutions to the reported challenges are related to the maturity of the systems. Once the potential benefits are clearly proven, the awareness will increase and evidence will be established.

4.6.6 Technical issues.

Technology was still reported as a barrier for a majority of the stakeholders. Mostly due to the fact that those systems tend to be more prototypes than commercial solutions, and also tend to be technology driven rather than healthcare driven. Several flaws were reported like the difficulties to make hard copies of the data, which makes the system less reliable and useful.

The solution appears to have robust and flexible commercial solutions. However, it should imply the commitment of the industry that could perceive these products as a potential market.

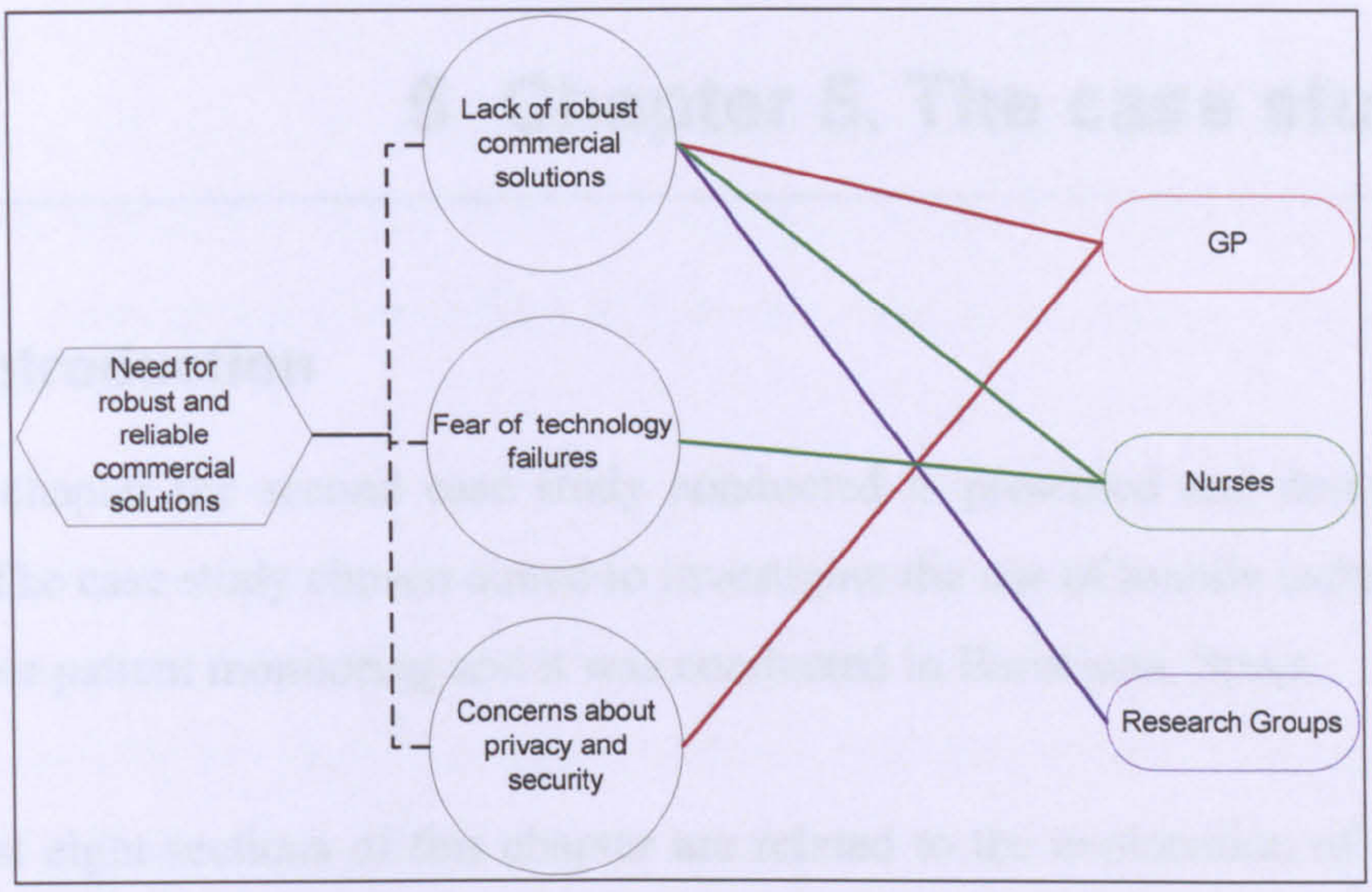

Fig. 4.10 Technical Issues

4.7 Summary

In this chapter the proposed benefit and barrier framework (BEBAF) has been presented. This framework is based on Social Construction of Technology (SCOT) and Stakeholder theories. It is followed by the exploratory case study, conducted in the UK. This case study was conducted to refine the research strategy, to obtain a preliminary list of stakeholder which could be applied in case study II as a starter list, and finally to try out the framework in a small, but similar system than the one chosen as the principal case study. As a result of its analysis, the preliminary list of stakeholders following BEBAF has been identified, with a comprehensive list of benefits and barriers to the adoption of such systems. The data was analysed using content analysis. They were codified in themes, and afterwards classified in six categories: clinical, economic, professional, patient-related, organisational and technical. This classification was the one chosen to divide the graphical representation of the proposed framework.

5 Chapter 5. The case study II

5.1 Introduction

In this chapter the second case study conducted is presented and described in detail. The case study chosen aimed to investigate the use of mobile technologies in remote patient monitoring and it was conducted in Barcelona, Spain.

The first eight sections of this chapter are related to the explanation of the case study and the data collected following the structure of BEBAF: the full list of stakeholders, the benefits reported and finally the barriers mentioned divided in categories. Section nine covers the application of the framework for each category with the analysis of the findings.

5.2 Description of the case study

The aim of this case study was to explore the use of mobile technologies to monitor respiratory patients with COPD (Chronic Obstruction Pulmonary Disease). Patients with COPD present serious difficulties to exhale normally. According to WHO, 75% of deaths from COPD are directly related to smoking tobacco. Each patient had a mobile phone and two sensors, a spirometer and a pulse oximeter. The spirometer records the amount and the rate of air that is breathed in and out over a specified time frame. The pulse oximeter measures the amount of oxygen in blood and the pulse. Additionally, a questionnaire with ten questions about their health condition was conducted on the mobile phone and depending on the answers, two types of alarms were activated. The schedule of monitoring sessions was arranged for each patient, usually daily, and their vital signals were sent through wireless and mobile technologies to the web patient record software. In the case where some of the data was exceeding a threshold, alarms were activated. Health professionals involved in the care team could access the data at any time, via a secure Internet connection.

The project was led by a tertiary private hospital (Hospital Clinic), which provides public services within the Catalan Health Services. The respiratory team was responsible for launching this project. Other healthcare organisations involved were: primary care teams with doctors and nurses and healthcare home services.

The system was developed by Motorola USA and is based on a Motorola 3G mobile phone with specific software developed in Java. Some of the components were: a web-based patient manager software and two wireless devices, pulse oximeter and spirometer connected via Bluetooth with the mobile phone.

A clinical protocol was defined for this group of patients and 140 patients were chosen to participate in the randomised control trial. 70 were randomised assigned to the control group and the other 70 to the intervention group. The intervention group were provided with the mobile devices plus some training sessions about the use of the technology and the healthcare aspects of the disease, such as pharmacological and life style issues. The control group followed their treatment as usual.

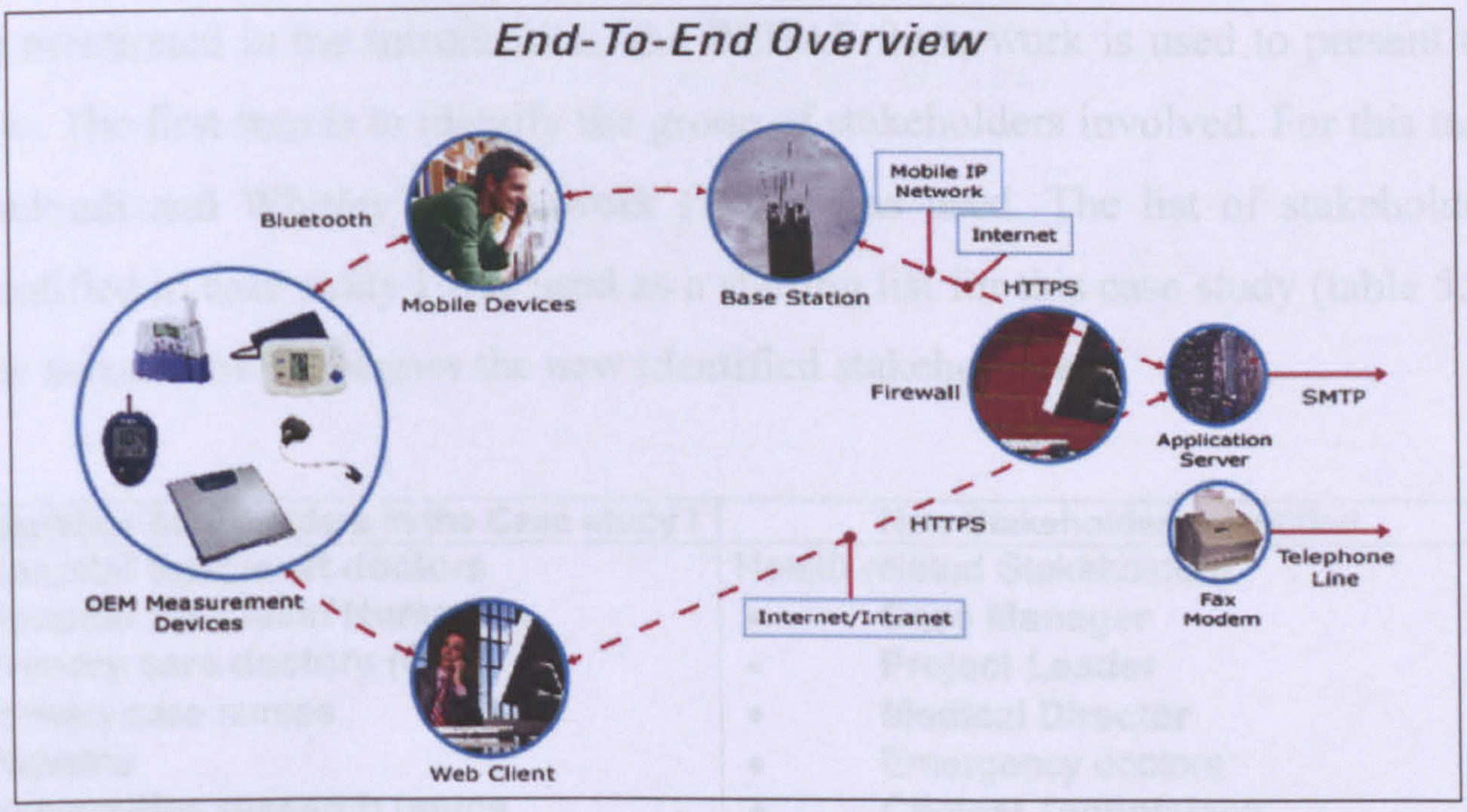

Fig. 5.1 Motohealth scheme

In case of an emergency, the intervention group had to contact the call-centre and a nurse decided what was better for the patient. The options were either come to an emergency room in the hospital, bring a doctor or a nurse to the patient's

home, forward the patient to the primary care doctor or just adjust the treatment over the telephone.

This case study was chosen for various reasons. The first reason was the possibility of having access to a project in which, diverse healthcare organisations were involved. This complexity was important to validate the framework. Another reason was the technology used. It was based on wireless devices connected to a mobile phone. This scenario was particularly useful to assess how the different types of users: -patients, carers and healthcare professionals- interact with the lastest technology available, without previous experience. In addition, the possibility of making most of the interviews to the stakeholders involved and of being able to interact with the research group were essential for this research. The research group was led by the respiratory department in the Hospital Clinic and the IS department. They facilitated my access to the stakeholders involved and helped me to contact different participants.

5.3 The Stakeholders

As mentioned in the introduction, the BEBAF framework is used to present the data. The first step is to identify the group of stakeholders involved. For this task, Pouloudi and Whitley's framework (1997) was used. The list of stakeholders identified in case study I was used as a starting list for this case study (table 5.1). The second column shows the new identified stakeholders.

Identified Stakeholders in the Case study I	New Stakeholders identified
Hospital Specialist doctors	Health-related Stakeholders
Hospital Specialist Nurses	• **Case Manager**
Primary care doctors (GP)	• **Project Leader**
Primary care nurses	• **Medical Director**
Patients	• Emergency doctors
Universities research teams	• **Clinical Technicians**
NHS central	• User support managers
Primary care trust	• **Hospital Researchers**
Social services	Industry stakeholders
Residential home inspectors	• Medical devices,
District nurses (visiting nurses)	• **Moblie phones**
Physiotherapist	• **Telecommunications**
Relatives	• Software

Identified Stakeholders in the Case study I	New Stakeholders identified
Hospital Managers Relatives Medical managers **Ethical approval committees**	• Internet Service providers **Local, Regional and General Authorities** Insurance companies Home agencies Disease management agencies **Home healthcare teams** Home-base caregivers **IS Managers** Patient associations Evaluation agencies Alternative medicine doctors **ERP system Managers** **IT Specialist** **Call-centre assistant**

Table 5.1 New identified stakeholders

During the interviews, they were asked to identify other groups, individuals or organisations that could be involved somehow in the system under study. Some of the new stakeholders also arose during the open questions.

A filter was applied to the complete list of stakeholders, and only those with an implication in the system under study at this stage were selected and interviewed. Figure 5.2 shows the first layer of stakeholders interviewed. Figure 5.3 and 5.4 show the second layer of hospital and industry stakeholders.

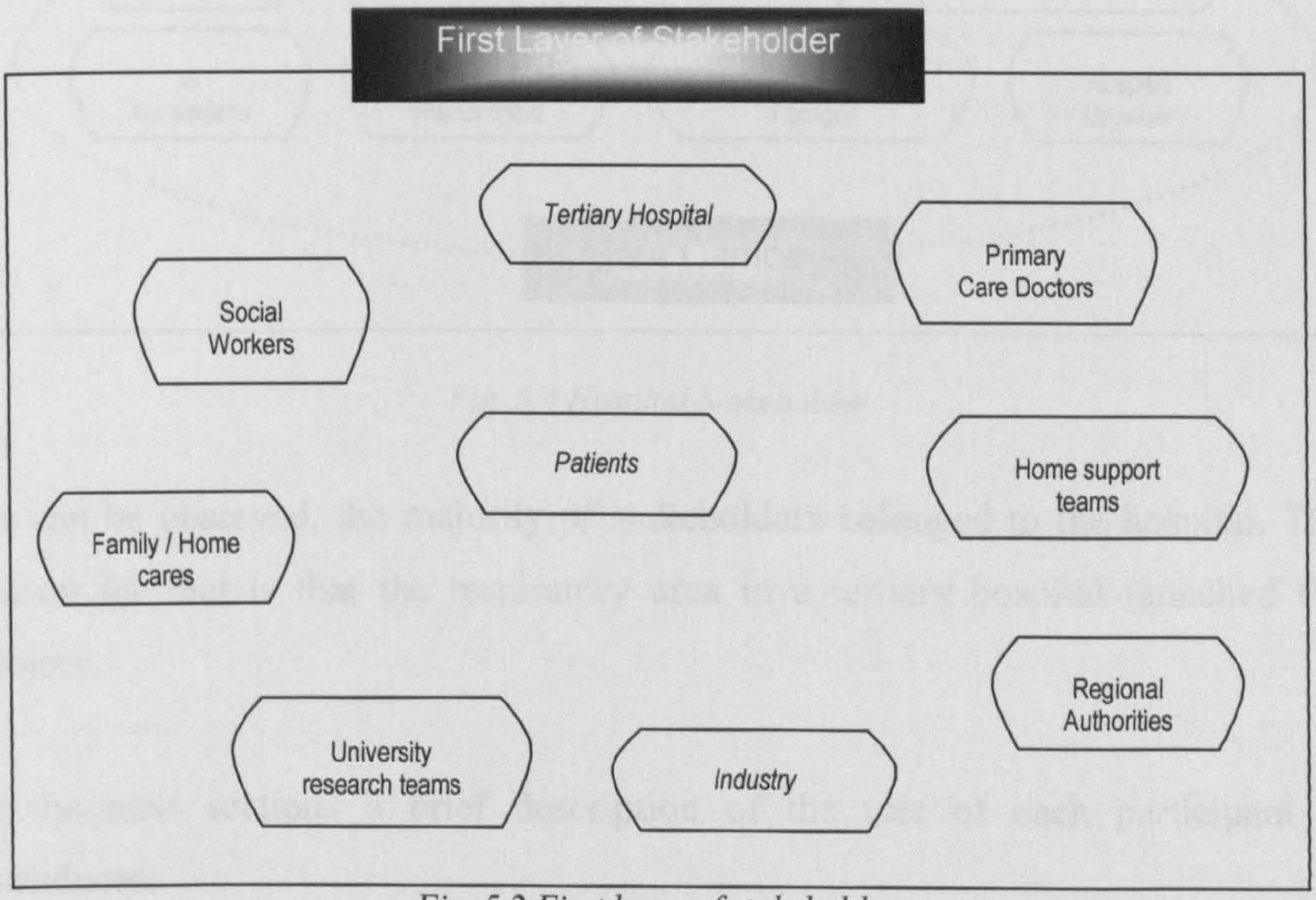

Fig. 5.2 First layer of stakeholders

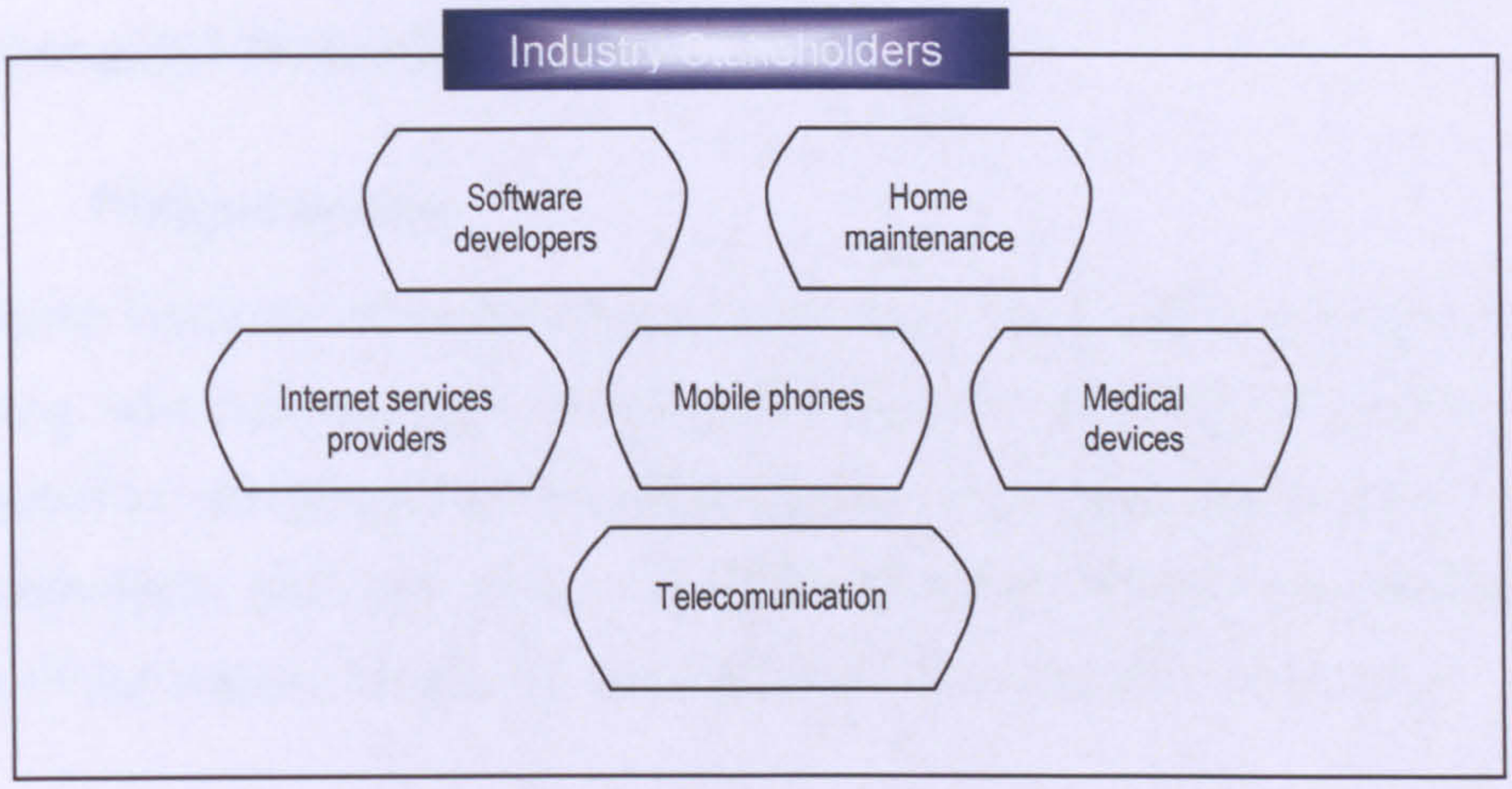

Fig. 5.3 Industry Stakeholders

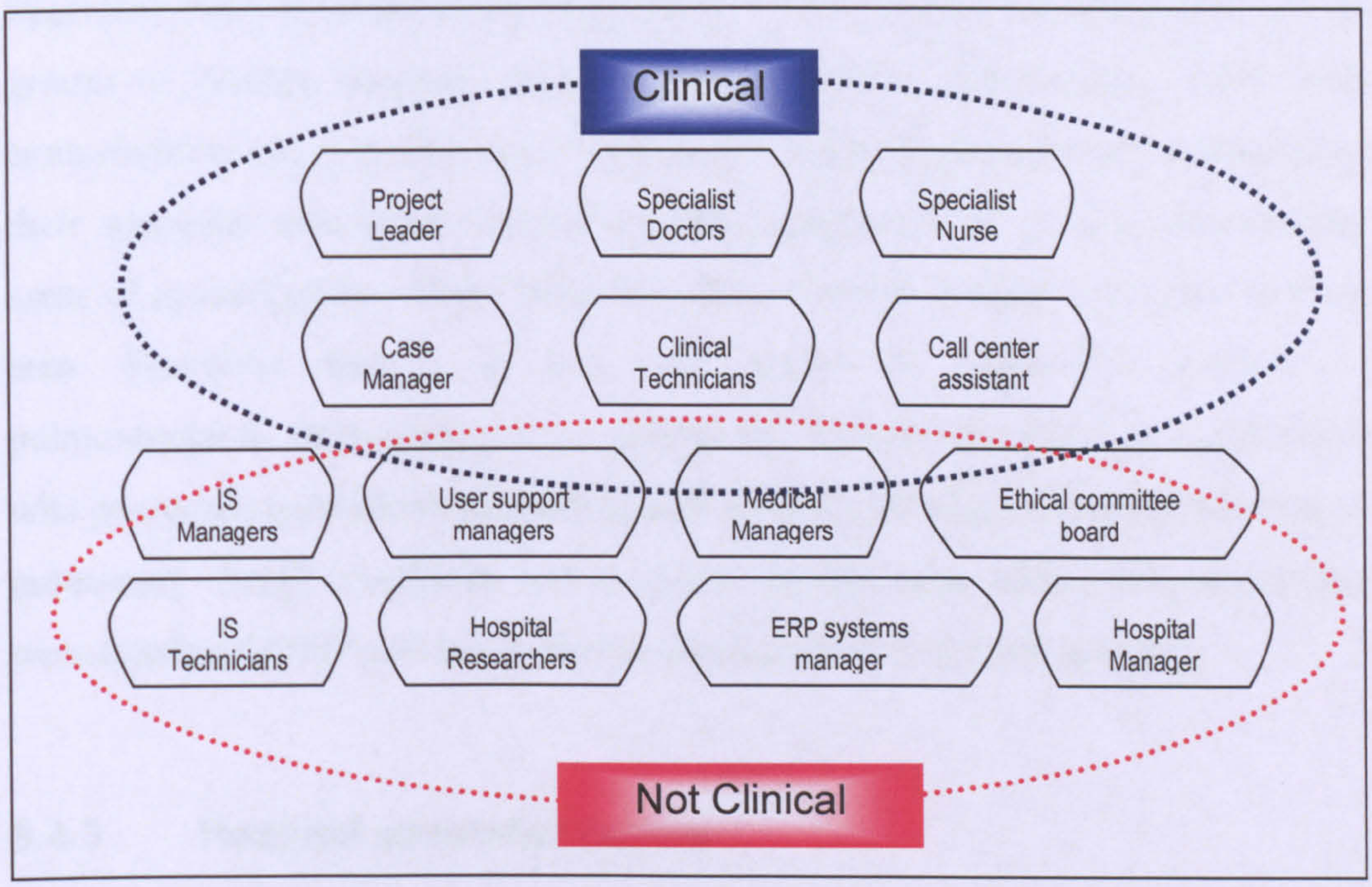

Fig. 5.4 Hospital Stakeholder

As can be observed, the majority of stakeholders belonged to the hospital. The reason for that is that the respiratory area in a tertiary hospital launched the project.

In the next sections a brief description of the role of each participant is introduced.

5.4 Hospital Stakeholders

5.4.1 Project leader

The project leader of this system was a specialist doctor who belonged to the respiratory area and who was expert in COPD and in telemedicine projects. His responsibilities are related to the management of the project, as a nexus for all the stakeholders involved, and as a bridge between clinical and managerial aspects of the project. Clearly, he was highly proactive towards the project.

5.4.2 Specialist doctors

Specialist doctors based in the hospital form this group of stakeholders. These groups of doctors normally treat the worst or more fragile cases, often with comorbidities and complications. They work divided in departments according to their speciality and some times even each department is divided into specific areas of specialisation. They frequently lead research projects and trials in their area. Specialist doctors in this case study are respiratory doctors or pulmonologists. Pulmonologist, or pulmonary disease specialist, is a physician who possesses specialized knowledge and skills in the diagnosis and treatment of pulmonary (lung) conditions and diseases. In this case study those specialists were treating COPD patients (Chronic Obstructive Pulmonary disease).

5.4.3 Hospital specialist nurses

Hospital nurses have a pivotal role in those types of systems. In most of the systems they are responsible for the follow up of patients and also for the majority of the clinical interventions. They are normally specialized in one clinical area. In this case study, hospital nurses were responsible for the coordination of the project and the link between patients and other healthcare professionals. When they were asked their role, they answered: "To coordinate the clinical program for the telemedicine projects in the respiratory speciality"

5.4.4 Case Manager

In this case study a specialist nurse in the respiratory area was the case manager. The case manager was responsible for coordinating the clinical aspect of each patient. She was the first to evaluate the clinical data, and depending on the health condition, to establish the clinical protocol for each type of patient in coordination with the specialist doctors. They were also responsible for the training sessions to patients and decided the clinical intervention that could be necessary.

5.4.5 Hospital clinical technicians

This group is normally formed by specialist nurses, responsible for the medical devices and clinical diagnostics test of patients in hospitals. To evaluate patients, respiratory technicians interview them, perform limited physical examinations, and conduct diagnostic tests. They can also define respiratory care therapeutic treatments to patients.

5.4.6 Call centre assistant

A nurse or a health-assistant is often accountable for supporting patients over the phone service. They act as a direct point of contact with patients. When a patient makes a phone call a predefined questionnaire is asked and an adequate action is taken depending on the answers. The assistant can ask the patient to come to the emergency room in the hospital, schedule a visit for her/him or to be contacted back by a specialist nurse or doctor.

5.4.7 Hospital Information Systems managers

This group of stakeholders has an important role in health institutions and hospitals because most of the activities related to healthcare are based on data, information and knowledge. Probably the most important of their responsibilities are the activities related to ERP and legacy systems and those related to clinical data record of patients. From their viewpoint, these new systems are still in an

early stage of development and should not be integrated with the legacy or ERP systems.

5.4.8 Medical Director

The Medical director or manager establishes and implements general policies, objectives, and procedures for the healthcare delivery within the hospital. A physician with great experience normally occupies this position.

5.4.9 Ethical Committee Board

This board is formed by a group of hospital managers from different areas and has the responsibility for deciding if each study or project is ethically viable and if all the paperwork, such as information for patients, is prepared. They examine the protocols and what kind of interventions are going to be conducted to patients. The ethical approval is required before any project can start.

5.4.10 IS Specialist Technicians

This group of stakeholders is responsible for technical aspects of the implementation of the system. They manage the relationships with the industry providers and check that all the requirements have been covered. They are responsible for security issues with the hospital networks as well.

5.4.11 Hospital Research group

This group is responsible for the research activities related to the project. They define the protocols to be followed, the consent form for patients, how to gather the data and how to use it. They finally produce reports, presentations and papers with the results and outcomes of the project. They can be internal personnel from the IS department or external groups dedicated to clinical research in the telemedicine area.

5.4.12 ERP systems manager

This group of stakeholders belonged to the IS department and are responsible for the ERP information systems. Their responsibilities include maintaining and supporting the Information Systems of the hospital and the connections with any other Information Systems that could be used in the hospital. In this case study, the ERP system, SAP was the core system of the hospital. The relevance of the ERP system within the hospital made it necessary to consider this group apart from the IS manager.

5.4.13 Hospital managers

This group is responsible for managerial issues in the hospital. They are responsible for most of the economical decisions in the hospital, such as new areas for investment. They also provide policies and guidelines for the hospital. However, they do not have direct implication over pilot projects conducted in the hospital. They would have responsibility only in the case that a project could be adopted in the hospital mainstream.

5.5 Primary care stakeholders

5.5.1 Primary care doctors

This group is responsible for primary care. Chronic patients are often directed to them after they have been diagnosed by a specialist or after being discharged from the hospital. They deal with the patient from a generalist viewpoint and are often responsible for prescriptions. Traditionally they have not been fully involved in research projects and consequently they have not participated in the definition of the systems. Their normal and regular routines frequently overload their dedication and, as a consequence, promoting research from their position becomes considerably difficult. However, other groups of stakeholders seem to perceive them as key and with a pivotal role within the integrated care model.

5.5.2 Home support teams

These stakeholders are a group of nurses, primary care doctors and social workers who provide healthcare to patients at home. Often, these groups are involved in palliative care at the end of life process. However, they also provide homecare services in chronic patients with little or no mobility.

Often, in projects where the target patient is an ageing patient with low income and resources, social workers are a key part on the projects. They give advice and resources in other areas such as home healthcare or home assistance. These types of resources are as needed as clinical care in those kind of patients. In this project, social workers were integrated in the homecare teams.

5.6 Non-clinical Stakeholders

5.6.1 University research teams

In this project a university research team from "Universidad Politécnica de Madrid, Escuela Superior de Ingenieros de Telecomunicaciones" was involved in the research project as evaluator of the solution and also defining the communication protocols between the ERP systems and Motohealth system. This research team has been involved in several telemedicine projects for hospitals. This type of collaboration between healthcare organisations, such as hospitals, and technical universities is quite common and useful to provide a different approach to research activities, especially to those related to technology, due to the different skills set that these teams provide.

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5.6.2 Regional Authorities

Though Spain is not formally a federal system, its political and administrative organisation is close to that model. In this scenario Regional authorities have responsibility over the health system in their respective geographies. They define policies for the general provision of healthcare. Also, as mentioned in previous chapters, the Spanish health system is a public, universal and free system for the whole population. Motorola funded this project during the pilot phase; however,

it would be funded by the public Healthcare System in the case that it were included as part of the regular health services.

5.6.3 Industry

As observed in figure 5.3, industry stakeholders can be divided in different organisations, mobile phones, telecommunications, software developers, home maintenance, Internet service providers and medical devices companies. Consequently, different people with diverse roles, into each of these organisations, are involved in the project. However, only mobile phone organisations and Telecommunication organisations were selected and interviewed. The main reason was because these two companies were directly involved in the project, whereas the rest of organisations acted as mere suppliers of equipment.

The e-Health market is still an emergent market with main industry actors trying to find a space in it by developing new products and services.

5.6.4 Families and patients

This group of stakeholders is the centre of the system; patients and families have a significant role as direct users of the system, uncommon in other health information systems. The patients selected for this trial were 60 to 85 years old, COPD patients. The selected group was a fragile segment, often affected by comorbidities, such as cardiac, diabetes or psychiatric diseases. One of the objectives of the system was to educate and empower patients in order to improve their self-management skills.

5.7 The benefits reported

In this section, the benefits found in the case study are presented. To identify the possible benefits, a series of predefined explicit questions were asked. Other benefits also arose during the open questions and unstructured conversation phase. The themes were identified and codified using content analysis. Once

identified, the benefits were classified in six categories: professional, clinical, patient-related, organisational and economic and technical benefits. In some cases, the benefits could be classified in more than one category. In such cases the most relevant classification was chosen. As mentioned in chapter 4, professional benefits were related to the improvement and development of professional healthcare work. Clinical benefits were related to the clinical aspects of the diseases. Organisational benefits were related to organisational structures and work procedures. Patient-related benefits were those related to the improvement in patients' quality of life and perceptions. Economic benefits were those related to the control of costs and funding opportunities. Finally, technical benefits were those that can be obtained only by the use of technology.

In the next sections, benefits are presented divided into the six categories mentioned before. For each category there is a table with a comprehensive list of all the benefits reported. The first column shows the total number of different groups who mentioned this particular benefit, and the second column the list of stakeholders who mentioned it.

5.7.1 Clinical Benefits

Table 5.2 shows the clinical benefits reported by the different stakeholders. 20 groups of stakeholders were interviewed. It seems clear for the majority of the stakeholders interviewed, that the evolution of a chronic condition cannot be changed. However, it can be better followed up and somehow delayed. Additionally, having access to continuous information about patients has significant implications: (i) Better control and follow up of patients. (ii) It increases the knowledge about how diseases evolve. (iii) It helps to normalise the use of similar clinical protocols. Consequently patients receive the same care independently of how they access the healthcare system. (iv) It can help to prevent acute conditions before they are produced. (v) It can facilitate personalisation of clinical care for each patient.

CLINICAL BENEFITS		
Nº	Who Reported	Benefit
10	Case Manager P. Leader H. Researcher S. Nurse H. Managers Uni. Researcher Ethic C. Industry H. Authority IT technician	Reduce hospital admissions & hospitalisation
7	H. Researcher Ethic C. Industry Home S. Group H. Authority ERP S.Manager Patients	Improve the patient care, treatment and follow up. Improve patient perception
6	Call-centre Ethic C. H. Authority G.P. ERP S. Manager Patients	Better control of patients. Specially those who live alone
5	Call-centre H. Manager Ethic C. Industry Patients	Decrease emergency room visits.
5	H. Researcher Industry T. H. Authority ERP S. Manager Medical D.	Allow new research and intervention before diseases get worse, allowing better disease evolution.
4	Medical D. Industry M. H. Authority Specialist Dr.	Allow to use similar clinical protocols, independently of how the patient accesses to the system
3	Clinical Tec. Specialist Nurse G.P.	Speed up processes in case of emergency. Control of any changes in the state of the patient.
3	Industry T. Industry M. H. Authority	Improve prevention of diseases.
2	Case Manager H. Authority	Improve the degree of compliance in patients
2	Case Manager Industry M.	Personalise the clinical care of each patient
2	H. Researcher H. Authority	Understand better the optimum clinical model. The impact of treatment over diseases
2	Clinical Tec. ERP S. Manager	Management of more structured information about patients.
2	Medical D. H. Authority	Allow new quality controls about medical process
1	Case Manager	Avoid deterioration due to hospital admissions
1	Case Manager	Facilitate home testing, avoiding patients' mobility.
1	Clinical Tec.	Reduce intervention time
1	ERP S. Manager	Reduce human-error through better automation of processes

Table 5.2 Clinical Benefits

The principal reported benefit was the potential of those systems to reduce hospital admissions and hospitalisation. This benefit implies significant benefits to healthcare systems, such as cost reduction, improve patient's quality of life, avoid deterioration, and in general a better follow up.

The second most mentioned benefit was the improvement of patient care, treatment and follow up. The integrated care model supported by these systems implies that patients are in the centre of the structure and the most appropriate healthcare group provides clinical care. Patients significantly improve their perception about how their disease is treated and participate more actively.

A better control of patients was mentioned by 6 different groups of stakeholders. Patients are better controlled and information about how their diseases are evolving is accessible at anytime. This is particularly important for those patients who live independently.

5.7.2 Economic Benefits

The main economic benefit mentioned was the possibility of achieving cost savings due to reduction of clinical interventions. Those clinical interventions were hospitalisation, specialist visits and emergency room visits (Table 5.3). For COPD patients 70 % of the cost of the disease is related to hospitalisation.

A powerful benefit for the telecommunications industry is to improve the use of the existing networks. Telecommunications infrastructure is already built, however its utilisation is scarce. These systems might be an attractive economy of scale for them, with the effect of improving the usage of the actual networks.

ECONOMIC BENEFITS		
Nº	**Who Reported**	**Benefit**
9	Case Manager H. Researcher P. Leader U. Researcher Industry M. Home Teams H. Authority ERP S. Manager	Potentially to save money through cost reduction in clinical interventions.

	IT Specialist	
1	Industry T.	Telecommunication industry can improve the utilisation of the actual networks with more data transmissions.
1	Industry T.	Get new captive clients for the telecommunication industry

Table 5.3 Economic Benefits

5.7.3 Organisational Benefits

The benefit more frequently mentioned by the participants was the improvement in the collaboration and communication between different healthcare professionals. In the actual healthcare model, collaboration between different healthcare levels is insufficient and most of the time based on personal and informal relationships. This shall also lead to a better use of the healthcare resources, allowing the patient to access the most appropriate level depending on their condition. Additionally, participants mentioned that these systems could help to improve efficiency and to speed-up clinical processes.

ORGANISATIONAL BENEFITS		
Nº	**Who Reported**	**Benefit**
7	Case Manager H. Researcher P. Leader U. Researcher Ethic C. Medical D. Specialist Dr.	Allow collaboration and communication between different healthcare professionals from different levels.
5	IS Manager Ethic C. Medical D. Industry M. ERP S. Manager	Helpful to rationalise the access to different resources.
5	IS Manager H. Researcher Medical D. ERP S. Manager IT Specialist	Improve efficiency and speed up clinical processes. Allowing more patients in the system.
2	IS Manager Case Manager	Multi-pathological patients can have access to different resources in an integrated model. Consider the patient as a whole
2	Case Manager P. Leader	Give better access to hospital to other healthcare professionals
2	Case Manager P. Leader	Share information and coordinate clinical interventions
1	Case Manager	Increase medical care in distant places, such as rural areas
1	Case Manager	A unique access point to the system for patients
1	Clinical Tec.	Increase use efficiency in scarce resources
1	Clinical Tec.	Help to redistribute the work load
1	Ethic C.	Help to reduce access to hospital

1	IS Manager	Helpful to find out untapped demand of new services
1	H. Researcher	Allow new sanitary models in aspects such as palliative care
1	Industry T.	Improve the technological level of the industry
1	Industry T.	Improve research areas in universities

Table 5.4 Organisational benefits

5.7.4 Patient-related benefits

Patient-related benefits are one of the groups with more significant advantages. Improving the quality of life of patients and their care has been the most reported benefit. Moreover, these systems help to improve patient's self-management. Patients learn to use the system and learn how to deal with the changes in their health condition. It reinforces their role and significantly improves their perception about the quality of care that is being received.

The improvement in the access and communication with healthcare professionals and the reduction in patient trips, especially important for patients with limited mobility, were also mentioned.

PATIENT-RELATED BENEFITS		
Nº	**Who Reported**	**Benefit**
8	Case Manager P Leader Specialist Nurse Industry T. Industry M. H. Authority ERP S. Manager Patients	Improve patient cares, quality of life and satisfaction
6	H. Researcher Specialist Nurse U. Researcher Industry M. Patients IT Specialist	Improve the patient self-management
6	Specialist Nurse G.P. U. Researcher Medical D. Specialist Dr. Patients	Improve access and communication to healthcare assistance
5	Specialist Nurse Home teams ERP S. Manager Patients Specialist Dr.	Reduce patient commuting

3	Specialist Nurse Call-centre G.P.	Patients get more confident about their treatment & the healthcare professionals
2	Patients IT Specialist	Patients gain autonomy and independence
2	Call-centre Case Manager	Improve the relationship with patients and their relatives
1	Industry T.	Can help to localize patients with an emergency or with cognitive problems
1	Industry T.	Allow patients be at home and consequently improve the social impact in the area
1	Patients	Feel more accompanied at home
1	Patients	Empower patients role

Table 5.5 Patient-related benefits

5.7.5 Professional benefits

Getting access to new knowledge and experience for non-specialist healthcare professionals was the most frequently mentioned benefit, which will also lead to improving the relationship between them. Also, as mentioned in the organisational group of benefits, work in collaboration would also contribute to a better interaction.

The second group of more mentioned benefits were those related to research activities. To have access to this new information will allow new clinical, pharmaceutical and epidemiological research.

PROFESSIONAL BENEFITS		
Nº	Who Reported	Benefit
4	Case Manager P. Leader Specialist Dr. Specialist Nurse	Give access to new knowledge, experience and techniques to no specialist healthcare professionals
3	Case Manager P. Leader Medical D.	Improve relationships between healthcare professional of different levels.
3	P. Leader Medical D. H. Authority	Allow new clinical and pharmaceutical research, due to 24 hour access to patient data
3	H. Researcher H. Authority P. Leader	Allow new epidemiological research. Allow to discover new ways to categorised patients
2	Case Manager Home Teams	Make the work more interesting
2	U. Researcher Medical D.	Be a pioneer with the use of technology
2	Case Manager P. Leader	Access to new technology, stimulate professionals
1	Specialist Nurse	Improve the emotional and human side of the work
1	Specialist Nurse	Improve the role of the nurses

1	Medical D.	Improve the access to clinical knowledge to new professionals

Table 5.6 Professional benefits

5.7.6 Technology benefits

This group of benefits was seldom mentioned but by patients who enjoyed having access to these new mobile phones. IS Managers also mentioned that technology can improve the process efficiency.

TECHNOLOGY BENEFITS		
N°	Who Reported	Benefit
1	IS Manager	Technology can help to do more thing more efficiently
1	Patients	Have access to cutting-edge technology

Table 5.7 Technology benefits

5.8 The barriers reported

The same strategy was used to identify the barriers or problems for the adoption of those systems. Several questions were asked to the stakeholders and the results were identified, classified and finally analysed. The results are presented divided into the same six categories.

5.8.1 Clinical barriers

The most reported clinical barriers were the lack of common protocols or clinical guidelines to deal with diseases. As a result each health organisation and sometimes each professional decides how to treat, what tests are necessary, or how to follow-up diseases. This barrier makes it difficult to work in collaboration and also to use similar systems in different organisations. In addition, three participants mentioned the problematic situation of dealing with patients with comorbidities. This condition is frequent in the ageing population.

CLINICAL BARRIERS		
N°	Who Reported	Barriers
5	Industry T. Industry M. Medical D.	Lack of common clinical protocols and clinical guidelines to deal with diseases

	H. Authority ERP S. Manager	
3	IS manager G.P. H. Authority	How to deal with patients with comorbidities
2	Ethic C. ERP S. Manager	It is unproven its efficacy in hospital visit reduction
2	P. Leader ERP S. Manager	Pilot projects have been unable to create truly scientific outcomes
1	Specialist Nurse	Lack of specific material for home assistance
1	Specialist Nurse	Limitation in the clinical processes that can be done
1	IS manager .	Difficulties to select the patient target. Which is the most appropriate criteria
1	ERP S. Manager	Difficulties of assessing the improvement in the healthcare attention
1	ERP S. Manager	Lack of objective indicator to assess the improvement
1	Specialist Dr.	It is unclear what vital signal need to be recorded

Table 5.8 Clinical Barriers

5.8.2 Economic barriers

Economic barriers were the ones with higher level of consensus. In general, 17 stakeholders mentioned the lack of funding as one of the main barriers for the adoption of such systems. Healthcare systems are government funded and access to healthcare is by definition universal and free. It means that if a technology innovation is available, it has to be openly offered to all the potential users. Additionally, actual healthcare systems do not cover some basic healthcare options, such as dental services. It means that in the case of providing the system with additional economic resources, they might be most probably applied to other needs perceived as more sensitive to the public services.

ECONOMIC BARRIERS		
N°	Who Reported	Barriers
17	IS manager H. Researcher P. Leader Call-centre Clinical Tec. Specialist Nurse H. Manager G.P. U. Researcher Medical D. Industry T. U. Research Industry M. Home Teams ERP S. Manager IT Specialist Specialist Dr.	Lack of investment in the area, funding problems. High initial funding. Unclear situation about who has to pay, hospital or regional authorities. Need of more mature solutions. Lack of resources in actual healthcare system

ECONOMIC BARRIERS		
Nº	Who Reported	Barriers
5	IS manager H. Researcher P. Leader Industry M. H. Authority	Financial issues among organisations. Reimbursements issues. Change in the business model
3	Call centre Industry T. Home Teams	Lack of financial reword to healthcare participants
2	Ethic C. Medical D.	Only 1% of expenses on technology, comparing with 7 % for banks and 20% of EEUU hospitals
1	U. Research	Still projects need to demonstrate that are cost-effective and that increase quality of life. It is needed larger pilots projects

Table 5.9 Economic Barriers

Five stakeholders also mentioned reimbursement issues. The actual system does not charge for service, so in the case of several organisations working together, this aspect would need to be redefined. Additinally, some participants mentioned the fact that the professional dedication to these pilot projects is done on a voluntary unrewarded basis.

5.8.3 Organisational barriers

Organisational barriers were the most reported and among them, the three main barriers identified were the following:

Firstly, the difficulty of coordination and the alignment of different healthcare organisations, which normally work independently, were reported. This barrier is also related to the leadership of the project. In theory, the most appropriate model is that primary care leads the projects, and coordinates all the available services. However, it clashes with the current model, in which primary care has no tradition of research activities and is often overcrowded by a large number of patients. This implies difficulties to participate in such pilot projects.

Secondly, change resistance in healthcare professionals was frequently mentioned. Healthcare professionals have a long tradition of working with a great autonomy and independence. This professional model tends to create reluctant behaviours towards imposed changes in existing working practices and processes.

A third significantly mentioned barrier was the incipient situation of these types of systems. The area is still emerging. It was followed by the lack of organisational culture to deal with this new model and the fact that nowadays the healthcare system is saturated.

ORGANISATIONAL BARRIERS		
N°	Who Reported	Barriers
12	IS Manager Case Manager H. Researcher P. Leader Clinical Tec. Specialist Nurse H. Manager G.P. Ethic C. Industry T. H. Authority Specialist Dr.	Too many actors involved, difficulties to align and coordinate all of them. A very fragmented system. Lack of tradition to work in collaboration. Those systems need to be dealt with by primary care services. Organisations are very complex. Research has been done by hospitals
12	Case Manager H. Researcher P Leader Specialist Nurse Medical D. U. Research Industry M. Home Teams H. Authority ERP S. Manager IT Specialist Specialist Dr.	Change Resistance in some healthcare professionals. Nurses and primary care doctors
9	G.P. Ethic C Industry T. Industry M. Home Teams H. Authority ERP S. Manager IT Specialist Specialist Dr.	The area is still emergent
6	IS Manager Ethic C. Medical D. U. Research H. Authority Specialist Dr.	Lack of organisational culture to deal with it. Healthcare sector has not been consider as an Industry
6	Clinical Tec. Specialist Nurse Ethic C. Industry T. Home Teams ERP S. Manager	Increase the workload. Have more active patients. Overcrowding
5	IS Manager H. Manager Medical D. H. Authority ERP S. Manager	Difficult to deal with the organisational impact. Resources need to be redistributed

ORGANISATIONAL BARRIERS		
N°	Who Reported	Barriers
5	Case Manager P. Leader U. researcher Home Teams H. Authority	Lack of training for professionals. Professionals are not trained in new technologies
4	Case Manager Clinical Tec. Industry T. U Researcher	Need of more support from authorities
4	G.P. Ethic C. Home Teams ERP S. Manager	Need of integrated information about the patient. Lack of integrated electronic patient record
4	Clinical Tec. Ethic C. Industry T. Specialist Dr.	Immaturity of the model
3	IS manager Specialist Nurse U. Researcher	Need to make virtual access compatible with normal hospital routine
3	Ethic C. Industry T. Industry M.	Primary care centres are saturated and are not efficient.
2	H. Researcher H. Authority	Difficulties to match technology with the real healthcare process and the real organisational model
2	H. Manager Industry T.	It needs to be lead by hospital managers rather than departments
2	Ethic C. Specialist Dr.	Unclear application in the hospital mainstream. Unknown organisational model
2	Medical D. Specialist Dr.	Healthcare is growing unorganised, just by individual leadership rather than by organisational planning.
2	Industry T. Home Teams	Healthcare professionals need to have access to technology resources
2	Industry T. ERP S. Manager	New personnel is needed in healthcare organisations, specialist in technology, to support patients and professionals
2	Industry M. H. Authority	Actual healthcare system is based on acute intervention rather than prevention. Lack of investment in prevention to avoid future diseases
2	H. Authority Specialist Dr.	Lack of awareness about the impact of chronic condition in the healthcare system
1	IS manager	Difficulties with competencies among organisations involved.
1	IS manager	Need to develop new access point to the systems for patients
1	Clinical Tec.	Private insurance companies do not accept chronic patients
1	Specialist Nurse	Patients are not considered as part of the team and not enough trained to use new techniques
1	H. Manager	It has to be a transversal project to manage chronic patient and to join services from different departments.
1	H. Manager	Resources in hospitals are scarce
1	H. Manager	Slow decision process in hospital
1	G.P.	Unclear about Who has to lead the project
1	Ethic C.	Lack of European regulation about common information
1	Call centre	Emergencies are not covered
1	Ethic C.	Lack of communication and coordination between healthcare levels

ORGANISATIONAL BARRIERS		
Nº	Who Reported	Barriers
1	Medical D.	Health authorities have a short sighted vision about what healthcare is
1	Medical D.	Managers need to consider it a critical point
1	Medical D.	Legal and ethic issues about information privacy and access
1	Industry T.	Lack of vision in healthcare organisations
1	Industry T.	Authorities have no technology vision
1	Industry M.	Telecommunication and Technology industry do not understand the medical business
1	U. Researcher	Difficult to automate the human part of clinics
1	ERP S. Manager	Rarely these projects have done healthcare consultation, just data and vital signal communication
1	Specialist Dr.	Importance of informal relationships
1	Specialist Dr.	Lack of organisational model to deal with the system and the coordination between healthcare organisations

Table 5.10 Organisational Barriers

5.8.4 Patient-related barriers

Patient-related barriers were barely mentioned, apart from the difficulties that some patients could experience using the technology. The target patients of this system were elderly patients; in consequence, systems must be user friendly for this specific public. Additionally, participants mentioned the fact that sometimes patients tend to trust more in specialists, saturating emergency rooms instead of attending the primary care service.

PATIENT-RELATED BARRIERS		
Nº	Who Reported	Barriers
7	U. Researcher Ethic C. Industry T. Home Teams U. Researcher ERP S. Manager Specialist Dr.	Patients can have difficulties using the technology. User interface need to be improved. Data capture process has to be simple
1	Ethic C.	Patients have to trust more in primary care
1	Industry M.	Patients have to be responsible for their own health
1	Patients	Not have access to test results

Table 5.11 Patient-related Barriers

5.8.5 Professional barriers

The most mentioned professional barrier was the need to get used to different ways of working. Another perspective of this barrier was the resistance to change reported among the organisational barriers. As mentioned before, telecare

systems support an integrated care model, in which different healthcare organisations and different healthcare professionals work in collaboration.

Additinally, the uncertainty about technology was also mentioned in several occasions. A number of healthcare professionals have been traditionally reluctant to use technology, although this is not happening with all professionals. Intensive use of technology in medicine is a relatively new phenomenon. Moreover, fear of technical failures, which might affect patient's health condition, can be considered as a necessary approach.

Several participants mentioned the change of role for professionals. A case manager coordinates clinical interventions and frequently manages these systems too. This case manager tends to be a nurse. In addition, patients change their role and become an active part of the team. They are users of the systems and they play an important role in the follow-up of the disease.

PROFESSIONAL BARRIERS		
Nº	Who Reported	Barriers
7	Case Manager P. Leader Specialist Nurse Ethic C. Medical D. Industry T. U. Researcher	Healthcare professionals need to get used to different ways of working.
7	Ethic C. Medical D. U. Research Industry M. Home Teams H. Authority Specialist Dr.	Uncertainty about new technology. Healthcare professionals tend to be reluctant about technology
5	IS Manager Specialist Nurse H Manager H. Authority ERP S. Manager	Change of role for professionals. Nurses empower their role. The patients empower their role in the system
4	Case Manager U researcher Ethic C. Industry T.	Difficulties with the extra time that health professionals have to dedicate. Without being paid
4	Clinical Tec. Ethic C. U. Researcher Specialist Dr.	Need more involvement and motivation of healthcare professionals.
4	H. Manager Industry T. Home Teams ERP S. Manager	Lack of awareness about telemedicine and its usefulness. Social pressure could bring it.

3	Case Manager H. Researcher IT Specialist	Most of the projects haven't been lead by healthcare professionals and has been more technology driven.
1	Clinical Tec.	Unclear Intellectual property
1	Specialist Nurse	Most of the work is for nurse and is not always acknowledged
1	Specialist Nurse	Nurses fear taking decisions and assume new responsibilities
1	G.P.	Most of the projects are personal initiatives difficult to extend
1	Medical D.	Fear of missing the personal contact between patient and doctor
1	Industry M.	Power factors between healthcare professionals
1	ERP S. Manager	Lack of powerful arguments in favour of those systems.

Table 5.12 Professional Barriers

5.8.6 Technical barriers

The most mentioned technical barrier was the lack of integration with the actual healthcare systems. It makes healthcare professionals use two different systems and sometimes two different computers to have access to patient's data. It brings integrity problems and difficulties to professionals, who, as mentioned previously, tend to be reluctant to technology. An additional barrier quite related to this one is the lack of connectivity. The systems of each healthcare organisation were not connected among them and did not follow the same codification standards.

The lack of robust commercial solutions was also often mentioned. Most of the projects are still in a pilot stage and technology is consequently not fully reliable. Once commercial solutions are marketed, the systems will go over systematic quality controls and the initial investment will likely be reduced.

TECHNICAL BARRIERS		
N°	Who Reported	Barriers
9	IS Manager Case Manager H. Researcher G.P. U. Researcher Ethic C. Medical D. Industry T. ERP S. Manager	Lack of integration with hospital information systems. Lack of data integrity

TECHNICAL BARRIERS		
N°	Who Reported	Barriers
7	IS Manager Case Manager H. Researcher P. Leader Clinical Tec. Home Teams ERP S. Manager	Lack of robust commercial solutions. Technology is still immature (Prototypes not fully reliable and operative, do not reflect all the functionality needed)
6	IS Manager Case Manager U. Researcher Ethic C. Home Teams ERP S. Manager	Systems need to integrated. Difficulties due to the use of different systems, quite different between them. Duplicate the work. Lack of universal patient identification. Regional competencies difficult to define a unique standard
4	G.P. U. Researcher Medical D. ERP S. Manager	Lack of standards in the data codification. Need to use similar codification for all the professionals involved
4	G.P. Industry T. U. Researcher Home Teams	Lack of tradition in the use of technology by healthcare professionals
4	Industry T. Patients IT Specialist Specialist Dr.	Concerns about data security, privacy and accuracy. Systems need to work 24/365
3	Medical D. IS Manager ERP S. Manager	Actual healthcare systems are financial administrative IS, adapted to give medical services. New IS is needed that can be based as medical systems
2	U. Research ERP S. Manager	Systems need to interpret results, professionals cannot process large amount of data. Need of Intelligent systems with high level alarms
1	Case Manager	Need of a quality control in the systems, they are not considered medical devices and do not pass those controls
1	Patients	Fear of technology failure
1	IT Specialist	Gap between technology and clinics
1	IT Specialist	Mobile communication technologies is immature

Table 5.13 Technology Barriers

The outcomes of this case study show a list of potential benefits and barriers for the adoption of telecare systems. In order to understand its implications in the adoption BEBAF framework would add a better insight.

5.9 Graphical representation of BEBAF to the Case Study

In the following sections, BEBAF will be represented divided in the six identified categories: clinical, economic, patients-related, professional, organisational and technical issues. BEBAF is a sociotechnical framework based on SCOT and stakeholder theories, which proposes to identify barriers and benefits to the adoption of such systems.

In order to try to simplify the graphical representation of the framework only the most mentioned benefits and barriers were represented. First, the map of the stakeholders involved in the system is presented (fig. 5.5). As mentioned in previous sections, only those stakeholders with a 'stake' in the project have been selected.

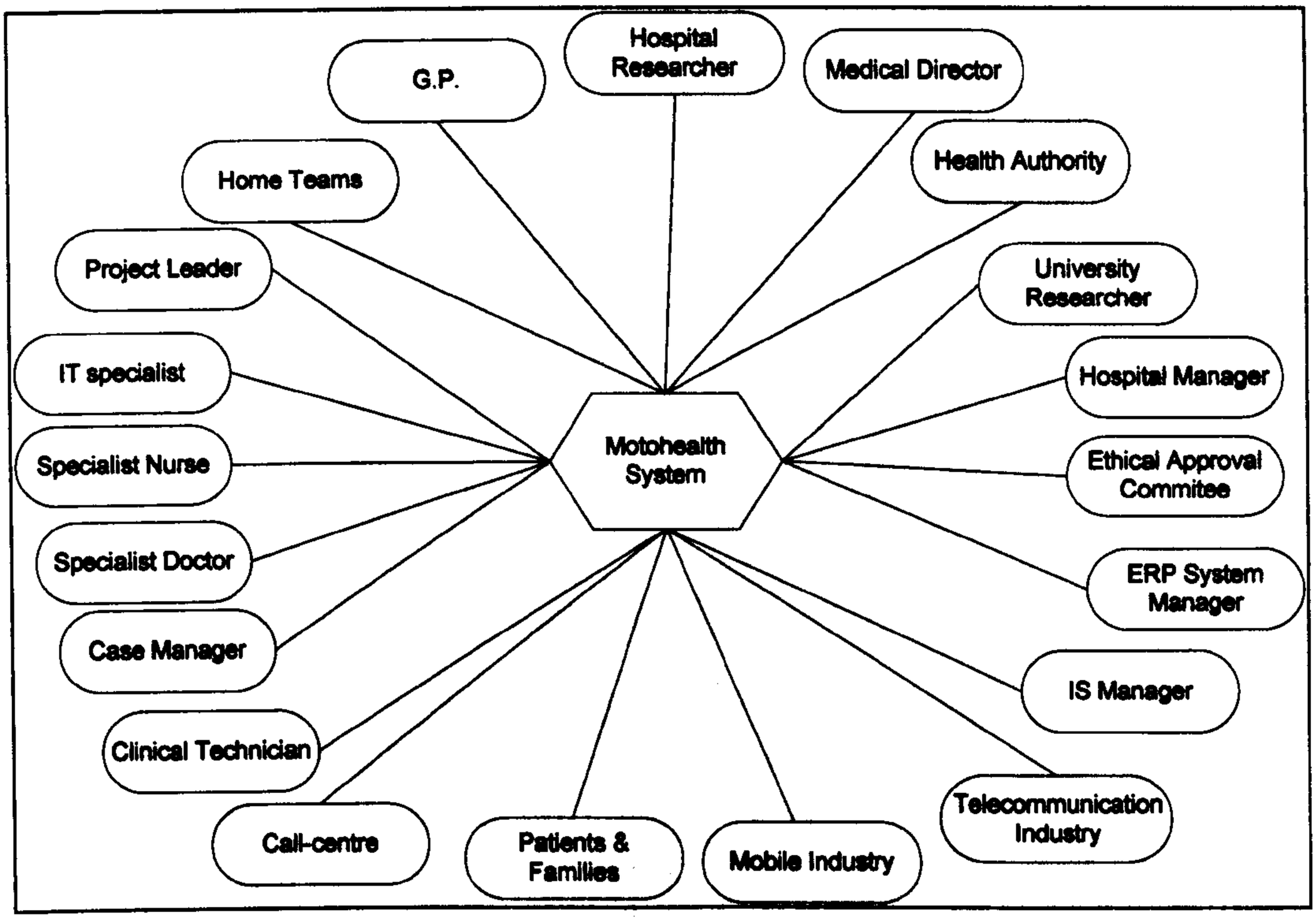

Fig. 5.5 Map of stakeholders

5.9.1 Clinical issues

The most mentioned clinical barrier was the lack of common clinical protocols and guidelines to treat patients. Each hospital establishes their own protocols and guidelines, and differences could be found even in the same department. Patients perceive that depending on who takes care of them: hospitals, specialists or primary care staff, recommendations and guidelines could be different.

On the other hand, the adoption of such systems can help to rationalise the clinical protocols and to assure that, independently of how patients access the system, they would receive similar clinical care.

A second barrier mentioned was the difficulty of dealing with patients with comorbidities. In actual healthcare systems a patient with more than one disease, which is common in elderly patients with COPD, are often treated by different specialists where there is no liaison between them. Those telecare systems propose the consideration of the patient in a holistic way. They provide the tools to establish formal coordination and to have access to integrated data about the patient.

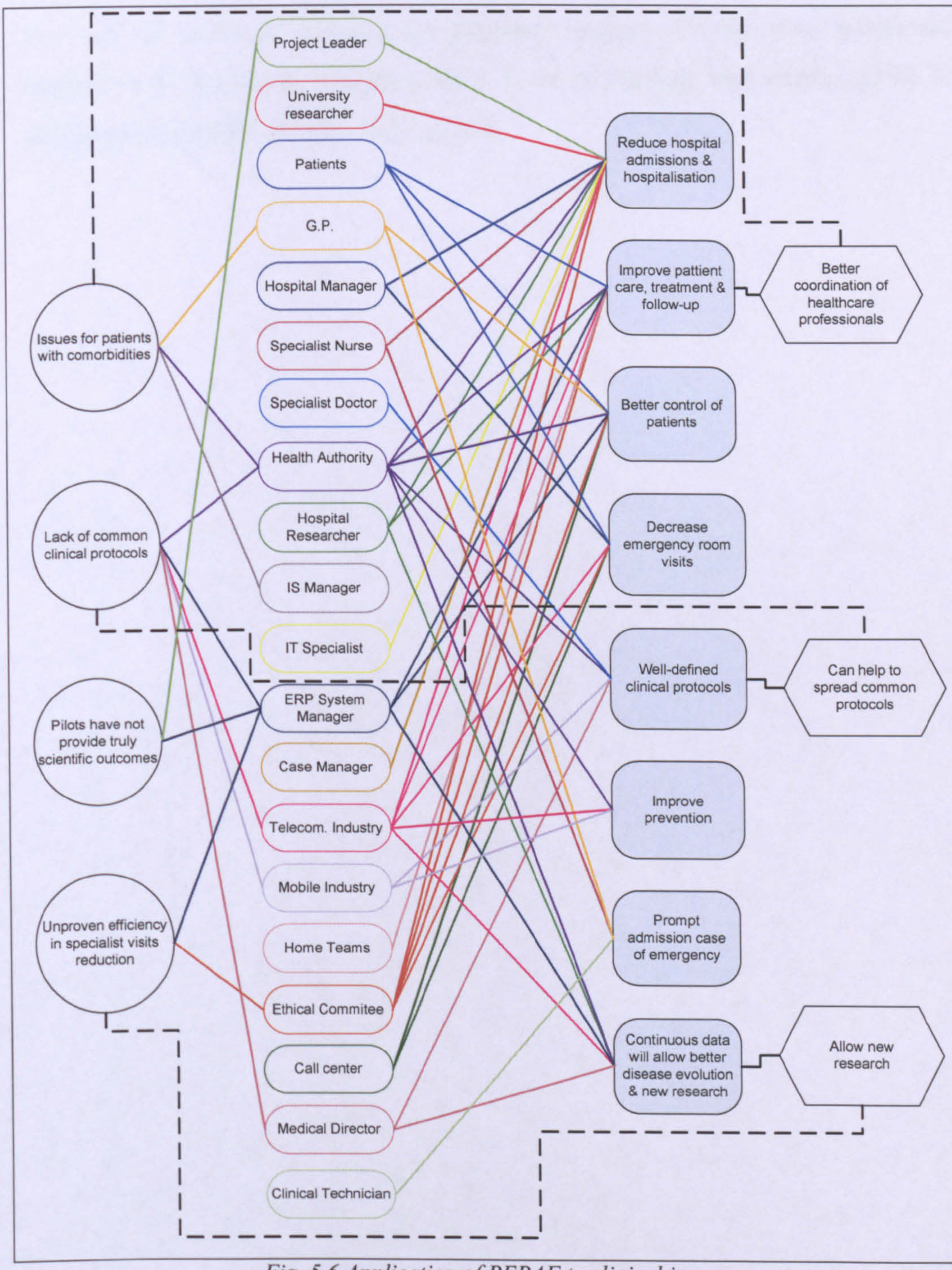

Fig. 5.6 Application of BEBAF to clinical issues

Another barrier mentioned was that those systems have not been enabled to produce real scientific outcomes. However, they provide continuous information about the evolution of the disease, which could lead to new pharmaceutical, epidemiologic and clinical research.

5.9.2 Economic issues

As cited the previous sections, the economic barriers are the most mentioned barriers to the adoption of such systems. Lack of funding was mentioned by 17 groups of participants out of 20 (Fig.5.6)

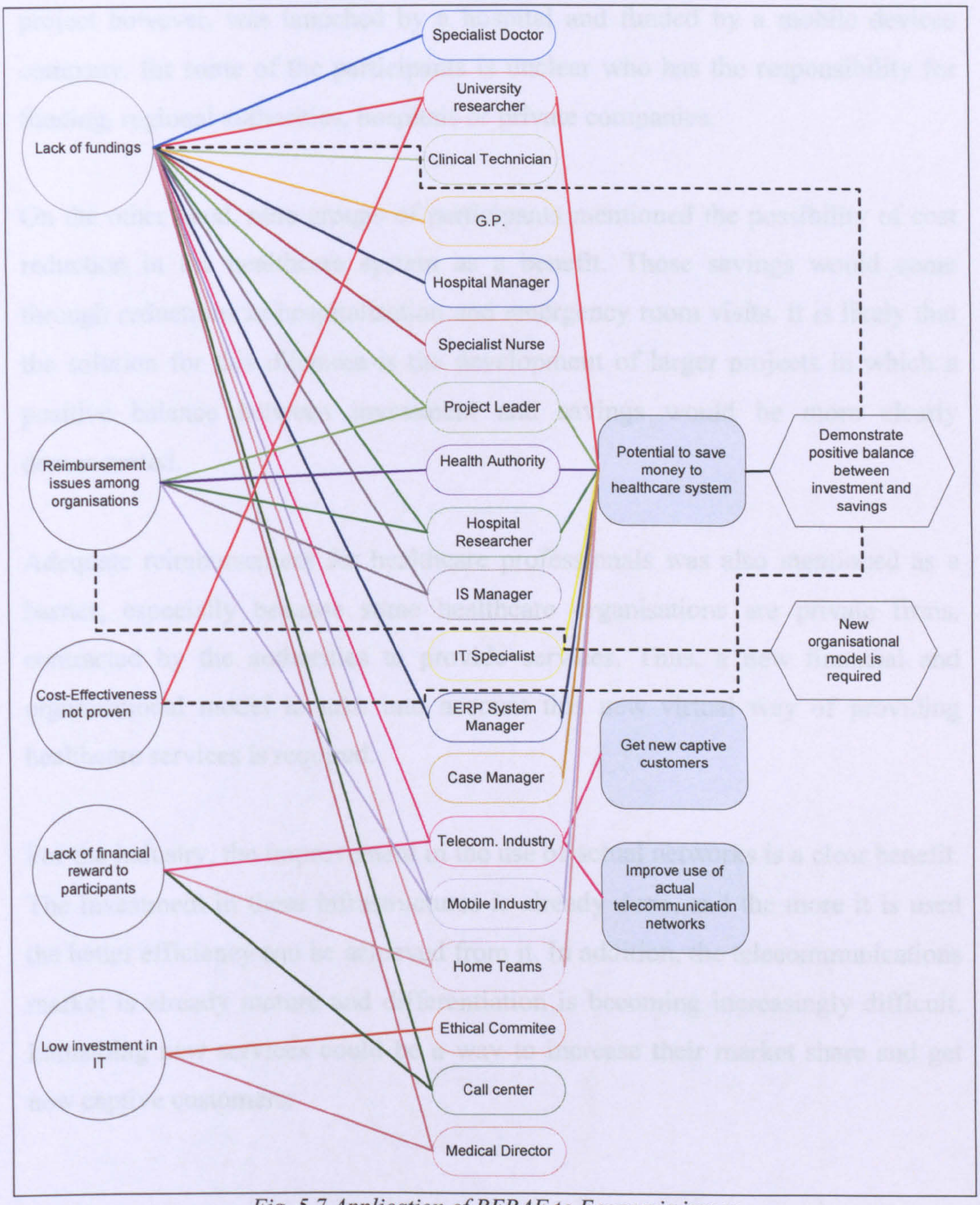

Fig. 5.7 Application of BEBAF to Economic issues

It is important to highlight that Spain has a public health system funded by public budgets. It is divided into autonomous regions or states. Health competencies have been transferred to them in most of the cases. Consequently, although there is a central health authority, most autonomous regions have their own health authority with responsibilities over a geographic area. Hence, local health authorities are responsible for making those investments in their area and they necessarily have to be universal, and available to all target patients. This pilot

project however, was launched by a hospital and funded by a mobile devices company. for some of the participants is unclear who has the responsibility for funding, regional authorities, hospitals or private companies.

On the other hand, nine groups of participants mentioned the possibility of cost reduction in the healthcare system as a benefit. Those savings would come through reductions in hospitalisation and emergency room visits. It is likely that the solution for this dilemma is the development of larger projects in which a positive balance between investment and savings would be more clearly demonstrated.

Adequate reimbursement for healthcare professionals was also mentioned as a barrier, especially because some healthcare organisations are private firms, contracted by the authorities to provide services. Thus, a new financial and organisational model to take into account this new virtual way of providing healthcare services is required.

For the industry, the improvement in the use of actual networks is a clear benefit. The investment in these infrastructures is already done, and the more it is used the better efficiency can be achieved from it. In addition, the telecommunications market is already mature and differentiation is becoming increasingly difficult. Launching new services could be a way to increase their market share and get new captive customers.

5.9.3 Organisational issues

As observed in the map of BEBAF for this category (Fig.5.7) there were more barriers reported than in any other classification.

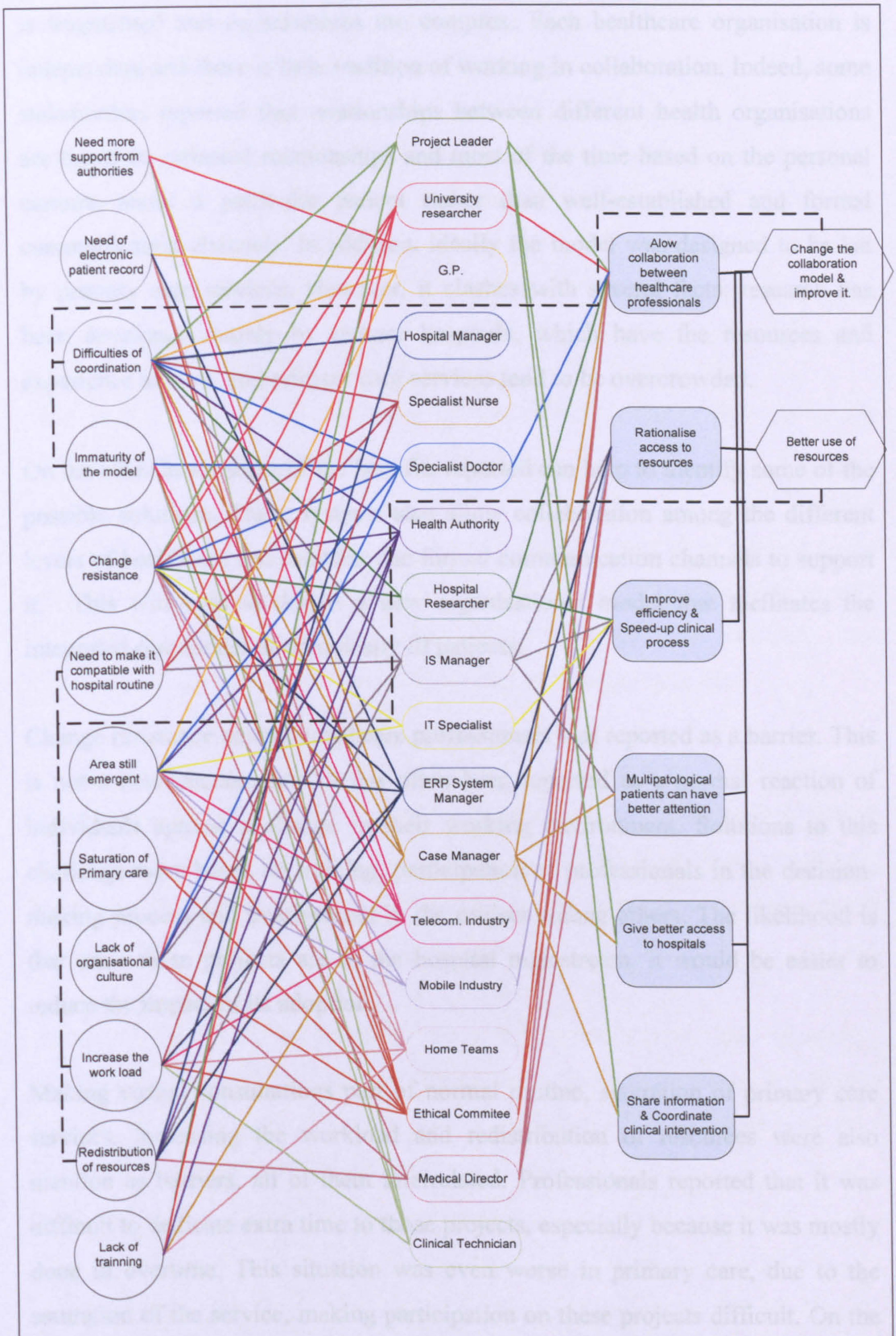

Fig. 5.8 Application of BEBAF to organisational issues

The most reported barriers were the difficulties of coordination between healthcare participants and resistance to change. The healthcare system in Spain

is fragmented and organisations are complex. Each healthcare organisation is independent and there is little tradition of working in collaboration. Indeed, some stakeholders reported that relationships between different health organisations are based on informal relationships and most of the time based on the personal concern about a particular patient rather than well-established and formal communication channels. In addition, ideally the model was designed to be led by primary care services. However, it clashes with several facts: research has been developed mainly by tertiary hospitals, which have the resources and experience to do it, and primary care services tend to be overcrowded.

On the other hand, some of the benefits reported can help to identify some of the possible solutions. These systems also allow collaboration among the different levels of healthcare and establish the formal communication channels to support it. This will help to design a new organisational model that facilitates the integrated care model of chronically ill patients.

Change resistance among healthcare professionals was reported as a barrier. This is not a new phenomenon, it has often been reported as a normal reaction of individuals against a change in their working environment. Solutions to this challenge were based on training, participation of professionals in the decision-making process and involvement in the project among others. The likelihood is that once those projects are in the hospital mainstream, it would be easier to reduce the impact of its adoption.

Making virtual consultations part of normal routine, saturation of primary care services, increasing the workload and redistribution of resources were also mention as barriers, all of them interrelated. Professionals reported that it was difficult to dedicate extra time to those projects, especially because it was mostly done in overtime. This situation was even worse in primary care, due to the saturation of the service, making participation on these projects difficult. On the other hand, some of the benefits reported could reinterpret these barriers: rationalise the access to resources, helping to avoid duplicated tests and revisions, and giving priority to the most efficient healthcare team for each intervention could help to reduce the workload and make a more efficient

redistribution of resources. In addition, telecare systems have the potential to provide shared information, improve coordination of clinical interventions, give formal access to hospitals to other healthcare professionals and improve efficiency by speeding up clinical processes. All those benefits could help to improve the use of actual resources and establish formal ways of collaboration among professionals.

5.9.4 Patient-related issues

Only a few participants mentioned patient-related barriers, although some benefits were frequently mentioned (see fig. 5.9).

The only relevant barrier is the need for making the usability of those systems compatible with the target patient: ageing people not used to technology or even to mobile phones and often with vision limitations. Once this area gets more mature, better commercial solutions will be progressively available.

On the other hand, it seems that benefits for this group of stakeholders are powerful and very frequently mentioned. Patients are the group that will receive more clinical and non-clinical benefits with the adoption of those systems. In detail, improving patients' care, quality of life and satisfaction with the system was frequently mentioned.

Improving the ability of self-care and self-management was also repeatedly reported. This will help to overcome the barrier of patients' health responsibility. Patients improve their role and their knowledge of the disease and take responsibility for their own-condition.

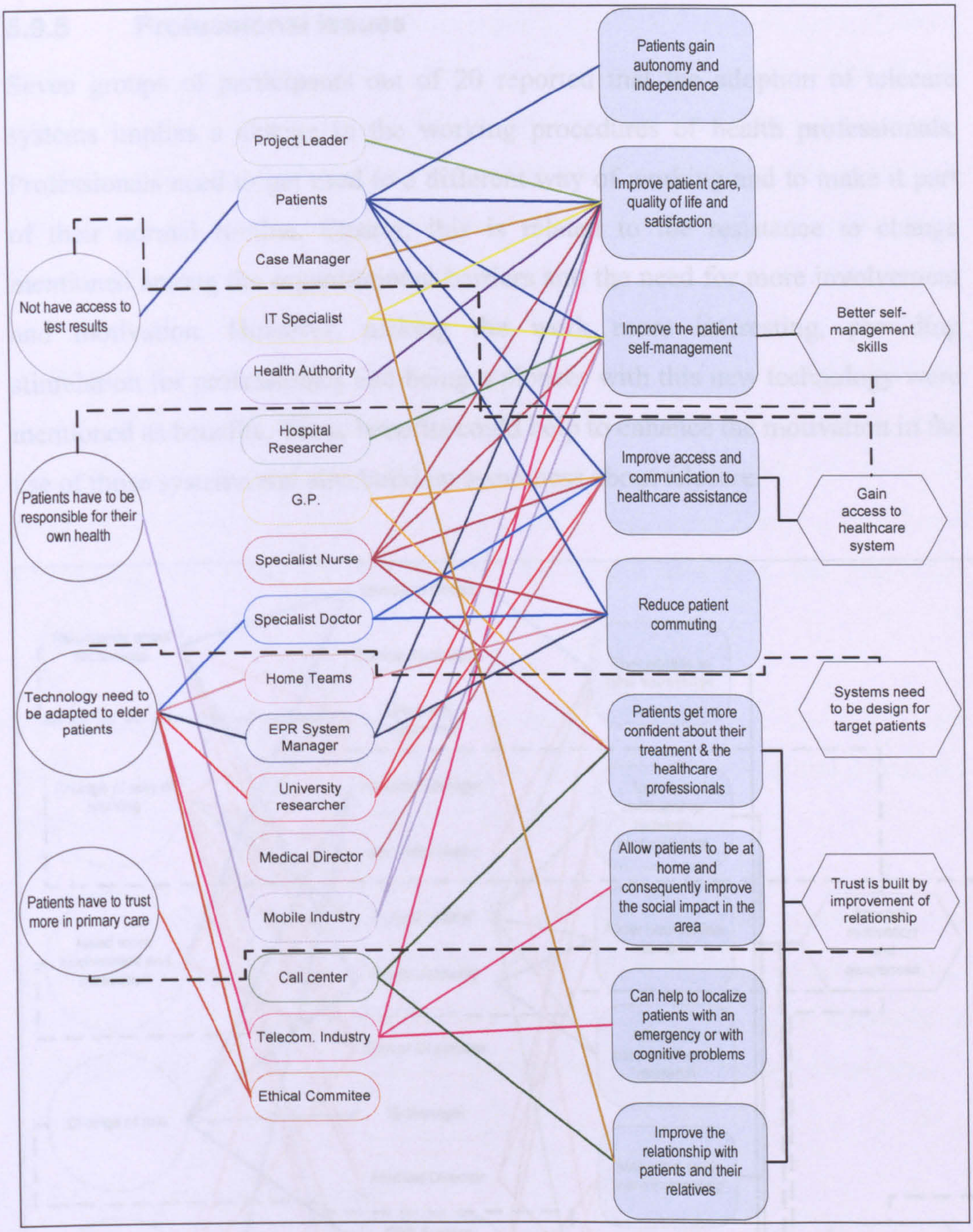

Fig. 5.9 Application of BEBAF to patient-related issues

Moreover, the lack of trust in primary care of some patients can be reduced by the reported benefits related to improving the relationship between professionals and patients. Patients and their relatives might become more confident with healthcare professionals and consequently, a trusted relationship would be built up with their healthcare group.

5.9.5 Professional issues

Seven groups of participants out of 20 reported that the adoption of telecare systems implies a change in the working procedures of health professionals. Professionals need to get used to a different way of working and to make it part of their normal routine. Clearly, this is related to the resistance to change mentioned among the organisational barriers and the need for more involvement and motivation. However, making the work more interesting, providing stimulation for professionals and being a pioneer with this new technology were mentioned as benefits. Those benefits could help to enhance the motivation in the use of those systems and also build up awareness about telecare.

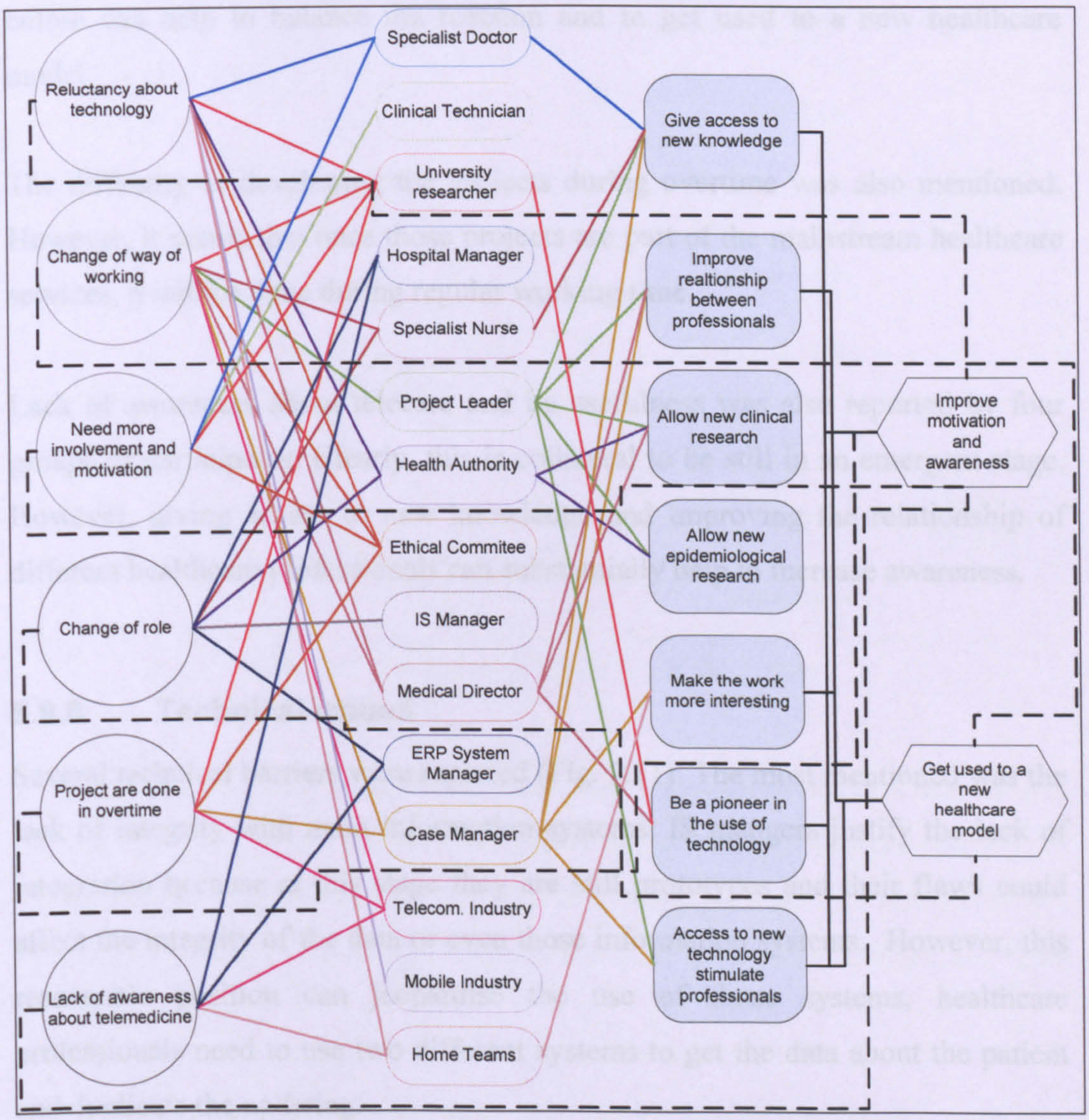

Fig. 5.10 Application of BEBAF to professional issues

Also, seven groups mentioned the uncertainty about new technology and some healthcare professionals being reluctant as barriers. On the other hand, stimulation of professionals in getting access to new technology and being a pioneer in the use of technology were mentioned as benefits. These benefits could help to overcome the reluctance about technology, balancing their perceptions.

Another barrier also mentioned was the change of role. In a traditional healthcare system, doctors tend to be in the centre of the model. It clashes, however, with this new model in which the patient is at the centre of the model and often it is nurses who coordinate interventions. However, the same benefits mentioned before can help to balance the reaction and to get used to a new healthcare model.

The difficulty of developing the projects during overtime was also mentioned. However, it seems that once those projects are part of the mainstream healthcare services, it will be done during regular working time.

Lack of awareness about telecare and its usefulness was also reported by four groups of participants. Clearly, this is collateral to be still in an emergent stage. However, giving access to new knowledge and improving the relationship of different healthcare professionals can substantially help to increase awareness.

5.9.6 Technical issues

Several technical barriers were reported (Fig. 5.11). The most mentioned was the lack of integrity with main information systems. IS mangers justify the lack of integration because at this stage they are still prototypes and their flaws could affect the integrity of the data or even those information systems. However, this reasonable position can jeopardise the use of those systems, healthcare professionals need to use two different systems to get the data about the patient and duplicate the updating.

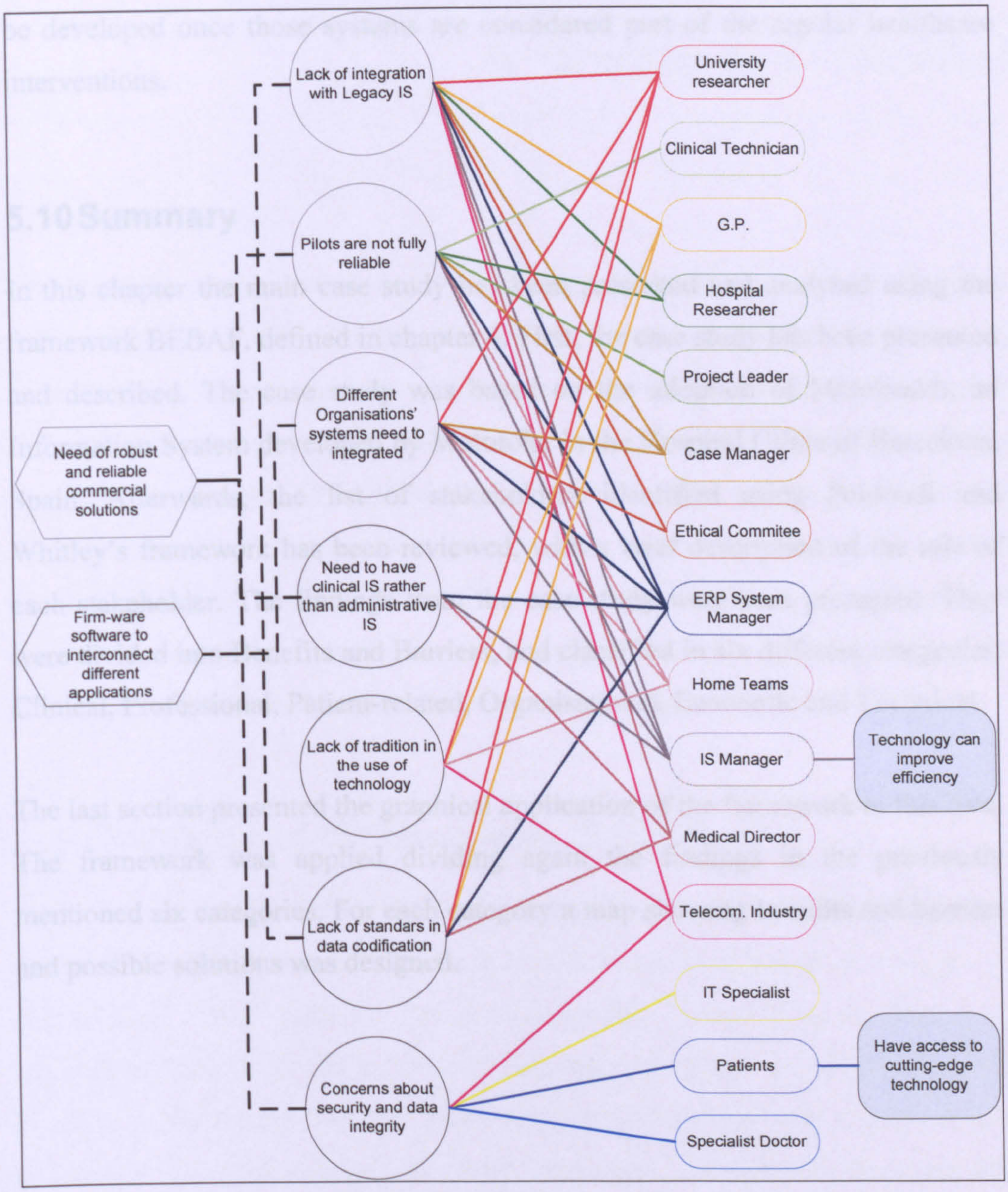

Fig. 5.11 Application of BEBAF to technical issues

An additional difficulty is added because each organisation involved has its own information systems and the data has been codified using different standards. At the same time, patients are not identified in a universal way. The solution to this challenge could be to develop firmware software to integrate information from different systems.

An additional problem comes from the lack of robust commercial solutions. Prototypes do not often reflect all the requirements, adding further difficulties to the regular use of the system. However, it seems clear that better solutions could

be developed once those systems are considered part of the regular healthcare interventions.

5.10 Summary

In this chapter the main case study has been presented and analysed using the framework BEBAF, defined in chapter 4. First, the case study has been presented and described. The case study was based on the adoption of Motohealth, an Information System developed by Motorola, in the Hospital Clinic of Barcelona, Spain. Afterwards, the list of stakeholders identified using Pouloudi and Whitley's framework has been reviewed, with a brief description of the role of each stakeholder. The findings from the case study were then presented. They were divided into Benefits and Barriers, and classified in six different categories: Clinical, Professional, Patient-related, Organisational, Economic and Technical.

The last section presented the graphical application of the framework to this data. The framework was applied dividing again the findings in the previously mentioned six categories. For each category a map showing benefits and barriers and possible solutions was designed.

6 Chapter 6. Evaluation

6.1 Introduction

The objective of this chapter is the evaluation and validation of the framework and the findings of this dissertation. First, the framework validation is presented by exposition of data analysis process and theoretical comparison with their precursors (further explanation of methods of evaluation can be found in chapter 3). In section 6.4, a data triangulation with the findings from both case studies and the literature review is conducted. Triangulation of findings from three different sources would help to assess the validity of these results: Case Study I, the e-Vital project, was explained in chapter 4. Case Study II: Motohealth project was presented in chapter 5 and the literature review in Chapter 2.

6.2 Evaluation of the framework (BEBAF)

Following the methods of evaluation suggested by Mays and Pope (2000) (See chapter 3) the effectiveness of the benefits and barriers framework is evaluated in this section. This evaluation has been conducted in several areas: First, by a detailed explanation of the methods of data analysis step-by-step, putting special attention to the outcomes in each stage. A theoretical evaluation of BEBAF is then conducted, by comparison with their precursors, SCOT and Pouloudi and Whitley's framework.

6.2.1 Method of data analysis: Step by step process

The benefits and barriers framework (BEBAF) is based on Social Construction of Technology (SCOT) with the combination of Pouloudi and Whitley's framework for stakeholders identification. First, the effectiveness of the framework was evaluated applying it to two case studies. The first case study was used as an exploratory case. Apart from using the case study to validate the effectiveness of the framework it also aided the understanding of the underlying methodology. It was beneficial to improve and refine the research strategy, to identify a

preliminary list of stakeholders and to provide a preliminary list of benefits and barriers. The second case study was larger in scope, time and number of participants. Its purpose was also to validate the effectiveness of the framework and their findings in a larger and more complex environment. A comprehensive list of stakeholders was identified, which led to the identification and classification of an extended list of benefits and barriers.

BEBAF was applied step-by-step following its sequence for both case studies. As a first step, a preliminary list of participants or stakeholders was identified for case study I (see chapter 4). The framework proposes an iterative way for finding the stakeholders. These initial groups of stakeholders were asked to identify additional stakeholders. Some others also arose during the interviews, while answering other diverse questions. The list that arose from case study I was used as a starting point for case study II. Again, the stakeholders from this list were asked to identify other stakeholders (see chapter 5). However, not all the stakeholders mentioned were interviewed. Some of them were discarded before doing the interviews because of their lack of implication with the project at this stage. Some others, even after the interviews, were not included in the analysis for the same reason.

During the semi-structured, open-ended interviews, participants were asked to identify possible benefits for them and for other stakeholders of those systems. The same strategy was used to identify the barriers to the adoption. Other questions related to the topic were conducted (see appendix A) in order to gain a better access of their perceptions. Those interviews were recorded, transcribed, and afterwards analysed using content analysis (fig.6.1.). Further information about the analysis process can be found in chapter 3.

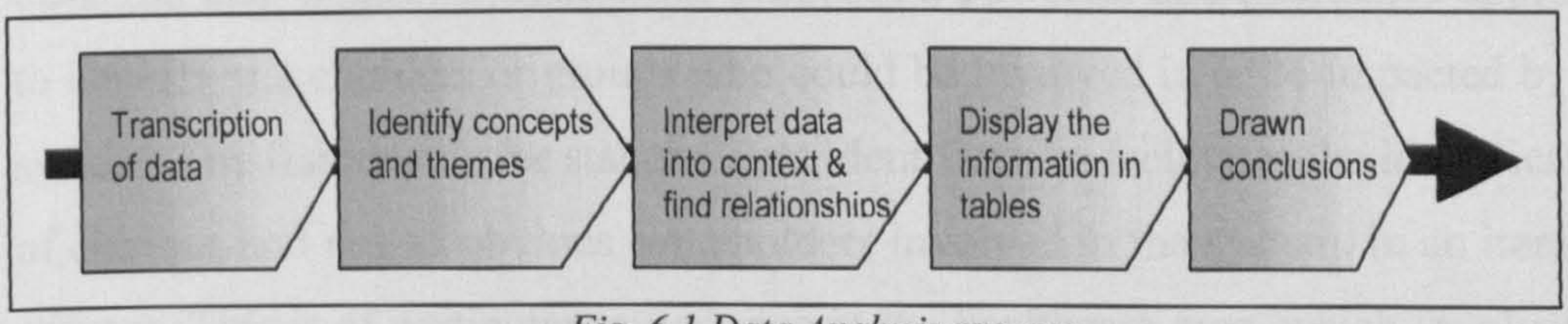

Fig. 6.1 Data Analysis process

BEBAF was used afterwards to graphically represent both benefits and barriers with the list of stakeholders and the possible solution. This representation facilitated a better understanding of the barriers for the delay in the adoption into the mainstream services, but also the motivators for it. Moreover, the representation discovered the relationships and the complex and sometimes confused perception of stakeholders. It also showed how some benefits and barriers were majority mentioned and how some of them were recognised by only some participants. Interestingly the representation indicated how a potential benefit for one group, such as primary care having access to specialist expertise was reported for secondary care participants. This representation also helped to define solutions, taking into consideration the perceived benefits. For instance a funding problem is reported as a relevant barrier for the adoption. However, taking into consideration the potential of saving cost in hospital intervention can help to balance the funding problem with the saving-cost potential.

6.2.2 Theoretical evaluation

Comparing BEBAF with SCOT and Stakeholder theories, BEBAF adds several advantages. The first benefit is to reinforce SCOT with a framework that proposes a systematic identification of stakeholders. Although SCOT includes group identification and more recent work of Bijker (1995) proposed to use a snowball process for identifying relevant social groups, its limitation in this area was already highlighted by Winner (1993). How to decide what are relevant social groups and what might happen with this other groups that have no voice, but could be affected by this new technology. In addition, power asymmetries, groups impact by technology (Klein & Kleinman, 2002) and iteration in their identification are issues not taken into account in SCOT. On the other hand, Pouloudi and Whitley's framework proposes a powerful and interactive approach to identify stakeholders or groups who could be involved in or be impacted by the system. The framework for stakeholders identification facilitates the identification of obvious and not so obvious stakeholders involved in the system, in an iterative process. This is of particular importance in the healthcare area, which involves by nature multiple interest groups, as presented in case study II (Chapter 5). A specific framework for identification of those groups can improve the

understanding of human, social and political issues that surround the adoption of e-Health systems.

Furthermore, BEBAF includes the identification of benefits. This research advocates that adding benefits and opportunities to the model reinforces it and provides new ways of stabilization and closure. As presented in Chapter 2, SCOT proposes two ways of closure, rhetorical closure and closure by redefinition of problems. The first closure is related to closing the controversies or barriers. It does not mean solving in the common sense of the word, but changing the perception of the issue as being resolved. Advertising has commonly been used to change or minimise the perception of a problem within a social group. The second closure: Closure by Redefinition of Problems, proposes to redefine some perceived issues as a solution for quite another problem, and hence change the perception of it by redefining the problem. In BEBAF a new closure has been added, the closure by reinterpretation of benefits. This new way of closure proposes that the barriers identified in previous stages are reinterpreted in the light of the possible benefits that could arise with the adoption of such system. This closure differs with the rhetorical closure in considering the benefits as a starting point to change the perception and find a solution. It also differs with the closure by redefinition of problems; this closure considers a barrier as a solution to another problem, but not a benefit as a solution. An example of this new closure is the following: funding problems has been mentioned as a relevant barrier to the adoption of such systems. However, the potential saving through reduction of clinical intervention, such as hospitalisation, is also a benefit mentioned. Justify the initial investment with the potential savings in the future in clinical interventions could be a closure for this issue.

Moreover, adding benefits to SCOT can help to balance the perception of the system. The framework can represent not only 'negative' issues but also 'positive' outcomes of the adoption. Human perception is shaped by the context in which it is produced. And the context can be enriched when benefits are considered apart from barriers. As observed in the maps in chapters 4 and 5, the representation is clearer and more complete when benefits are represented apart from barriers.

BEBAF adds a new insight to the perceptions and expectations of stakeholders about the adoption of such systems

6.3 Data triangulation: Validation of findings

The objective of this section is to validate the outcomes of this research. For this purpose triangulation with the data from both case studies and the literature review is conducted. When validating the finding, the efficiency of framework is validated as well as the method used to gather those findings.

The section is divided into the six categories used before: clinical, economic, organisational, patient-related, professional and technical issues. Through this division, analysis is simpler because a smaller and more cohesive amount of data is managed.

In general the literature has reported less barriers or problems to the adoption than those found out in the cases studies. For instance, there were no clinical barriers reported in the literature review (see Chapter 2), though there were some identified during the case study. Academic literature tends to report successful cases more frequently than failures (Heeks, 2006). According to this author, there is a negative bias against the publication of failures in the medical information systems literature. This implies a lack of negative outcomes reported, and consequently, those problems could not to be addressed.

6.3.1 Clinical issues

Table 6.1 and 6.2 represent the clinical barriers and benefits found in both case studies and in the literature review.

The first key finding of this validation is the significant number of barriers and benefits reported in case study II, compared with case study I and even more compared to the literature review (see Chapter 2). The reason for those differences might be the scope of the case study II, in which several organisations were involved, hospital, home support teams, primary care, university, regional

authorities, private industry companies, with a relevant number of stakeholders in some of them.

CLINICAL BARRIERS	Case Study II	Case Study I	Literature review
Lack of common clinical protocols and clinical guidelines to deal with diseases	X	X	
Pilot projects have been unable to create truly scientific outcomes	X	X	
How to deal with patients with comorbidities	X		
It is unproven its efficacy in hospital visit reduction	X		
Lack of specific material for home assistance	X		
Limitation in the clinical processes that can be done	X		
Difficulties to select the patient target. Which is the most appropriate criteria	X		
Difficulties of assessments the improvements in the healthcare attention	X		
Lack of objective indicator to assess the improvement	X		
It is unclear what vital signal needs to be recorded	X		

Table 6.1 Comparison of Clinical Barriers

The outcomes from 'case study I' were ratified and validated by the outcomes from 'case study II'. The two barriers mentioned in both case studies were the lack of uniformity in clinical protocols and the lack of truly scientific outcomes from pilot case studies. The first barrier is closely related to the difficulty of applying an Information System, which could be adapted to the variety of protocols and clinical guidelines that are normally used by each healthcare organisation. According to Phansalkar *et al.* (2007) computerised clinical protocols have achieved limited success among healthcare professionals. Medical protocols are not universal, even in the same healthcare geographical area. In some cases there are no formal protocols and healthcare professionals just follow their own criterion. It highlights the difficulty of making a universal software application, which could match most of the cases. Even in the case of flexible software it would need a bespoke adjustment.

The second barrier mentioned in both case studies is about the difficulties of making truly scientific outcomes from pilot case studies. Medicine studies are evidence based. Hence, scientific outcomes are expected from any projects in order to establish evidence based on the area. However, telecare projects have not been researched with truly scientific hypothesis, but with other variables, such as

cost-reduction, improving quality of life or cost-effectiveness, that might not be considered formally 'scientific'. This different approach makes it difficult to set evidence based outcomes and therefore contributes to the adoption.

CLINICAL BENEFITS	Case Study II	Case Study I	Literature Review
Reduce hospital admissions & hospitalisation	X	X	X
Understand better the optimum clinical model. The impact of treatment over diseases	X	X	X
Improve the patient attention, treatment and follow up. Improve patient perception	X	X	
Allow new research and intervention before diseases get worse, allowing better disease evolution	X	X	
Speed up processes in case of emergency. Control of any changes in the state of the patient.	X		X
Improve prevention of diseases.	X		X
Improve the degree of compliance in patients	X		X
Avoid deterioration and complications due to hospital admissions	X		X
Reduce human-error through better automating of processes	X		
Personalise the clinical care of each patient	X		
Better control of patients. Especially those who live alone	X		
Decrease emergency room visits.	X		
Allow to rationalised clinical protocols, independently of how the patient accesses the system	X		
Manage more structured information about patients.	X		
Allow new quality controls about medical process	X		
Facilitate test done at home, avoiding patient travel	X		
Reduce intervention time	X		
Increase of Clinical Usefulness			X
Reduction of mortality			X
Decrease nursing home placement			X
Improve clinical outcomes			X
Reduce the health risk of sitting in waiting rooms			X

Table 6.2 Comparisons of Clinical Benefits

It is important to highlight that the evolution of a chronic disease can only be mitigated but not completely cured. This fact shapes the perception of clinical benefits by all the participants, more based on delaying the evolution than on improving the health condition. Therefore, benefits reported were related to improving the compliance, the emergency processes and avoiding complications, than improving or curing the chronic condition.

The same can be said in the case of barriers, the benefits mentioned in case study I were ratified in case study II and also in the literature review. However, in the case of benefits, some of them reported in the literature review were not

corroborated by any of the case studies. One reason for that may be the different context of each research project and the differences in the projects which might produce different results.

Reduce hospital admissions and hospitalisations were reported by the three sources. This seems to be one of the key benefits of those systems. This benefit implies an important reduction of cost, an improvement in the evolution of the disease, an enhancement of patients' quality of life, a decrease of complications and deteriorations, and a reduction of waiting lists among others.

The second benefit mentioned by all the sources was to better understand the optimum clinical model. Telecare systems allow gathering continuous data about vital signals and disease evolution. This information can provide a better understanding about how particular diseases evolve and how different treatments affect this evolution. This new information not available before, could provide 'truly scientific outcomes' about clinical aspects and facilitates overcoming the mentioned barrier.

The improvement in patient attention, treatment and follow up was also mentioned in both case studies. It was facilitated by the access to continuous vital signals, as the previous benefit mentioned.

6.3.2 Economic issues

In tables 6.3 and 6.4 the outcomes from the three sources are presented. The economic barrier related to the high initial investment was cited in the two case studies and also in the majority of the academic literature. This barrier is considered one of the most important obstacles to the adoption of telecare projects.

The differences founded in Case Study I and Case Study II are more related to the difference of both healthcare systems: Spain and UK. Actually, NHS is funding projects in the UK; however, in Spain, the equivalent National Health Service is decentralised and it is rarely funding these research projects. Funding usually

comes either from the European Union or from private companies, such as telecommunications or mobile device companies. This fact motivated participants in case study I to mention that NHS was not interested in funding regular service provision, whereas in case study II, it was not mentioned at all.

ECONOMIC BARRIERS	Case Study II	Case Study I	Literature Review
High initial funding for the set up of a telecare project.	X	X	X
Still projects need to demonstrate that they are cost-effective and that there is an increase in quality of life.	X		X
Financial issues among organisations. Reimbursement issues. Change in the business model	X		X
Only 1% of expenses on technology, comparing with 7 % for banks and 20% of EEUU hospitals	X		
Lack of financial reward to healthcare participants	X		
Drug companies do not invest in this type of systems yet. (Traditional investors)		X	
Health authorities are more interested in funding pilot projects, than actually funding mainstream projects.		X	

Table 6.3 Comparisons of Economic Barriers

There is a clear consensus about the potential of telecare systems in cost reduction through the reduction of clinical interventions, such as hospitalisation, emergency-room visits and specialist visits. This benefit can facilitate the reinterpretation of the high initial cost of set-up of those systems.

ECONOMIC BENEFITS	Case Study II	Case Study I	Literature Review
Potentially to save money through cost reduction in clinical interventions.	X	X	X
Reduce cost through reduction of medication	X		
Telecommunication industry can improve the use of the actual networks with more data transmissions.	X		
Get new captive clients	X		
Indirect cost reduction			X

Table 6.4 Comparisons of Economic Benefits

6.3.3 Organisational Issues

Tables 6.5 and 6.6 show the similarities and differences in benefits and barriers reported by the three sources, Case Study II, Case Study I and the selected literature review.

In this category, most of the findings from Case Study I were also reported in Case Study II and also in the literature review. However, organisational barriers were not especially mentioned in the literature. The impact of telecare systems on organisational structures may be developed further. It is likely that, the main cause may be the scarce adoption of such systems into the mainstream services, in which the organisational impact would be relevant.

The two barriers mentioned by the three sources were the lack of training for healthcare professionals and the insufficient support from managers to this type of systems.

The differences in organisational barriers between the UK case study and the Spanish case study might be due to the differences in the authorisation research process. In the UK, it has to be done by the NHS with a COREC form, whereas in Spain, the hospital has its own internal department to deal with it. It makes the authorisation process simpler and faster.

In addition, two of the most mentioned barriers in the Case Study II, difficulties of coordination of actors and the resistance to change among professionals are likely to be related to the complexity of the selected case study and also due to the Spanish healthcare system in which formal collaboration is still underdeveloped. Healthcare organisations in Spain from different healthcare levels are still very independent and collaboration is limited.

ORGANISATIONAL BARRIERS	Case Study II	Case Study I	Literature Review
Lack of training for professionals. Professionals are not trained in new technologies	X	X	X
Managers need to consider it a critical point	X	X	X
Difficult to deal with the organisational impact. Resources need to be redistributed	X	X	
Need to make virtual access compatible with normal hospital routine	X	X	
Health authorities have a short sighted vision about what healthcare is. Lack of awareness	X	X	
Patients are not considered as part of the team and are not enough trained to use new techniques	X	X	
Slow decision process in healthcare system	X	X	
Increase the workload. Have more active patients. Overcrowding	X		X
Change Resistance in some healthcare professionals. Nurses and primary care doctors	X		X

ORGANISATIONAL BARRIERS	Case Study II	Case Study I	Literature Review
The area is still emergent	X		X
Authorities have no technology vision	X		X
Need of more support from authorities	X		
Difficulties to match technology with the real healthcare process and the real organisational model	X		
Too many actors involved, difficulties to align and coordinate all of them. A very fragmented system. Lack of tradition to work in collaboration. Those systems need to be dealt with by primary care services. Organisations are very complex. Research has been done by hospitals	X		
Lack of organisational culture to deal with it. Healthcare sector has not been considered as an Industry	X		
Need for integrated information about the patient. Lack of integrated electronic patient record	X		
Immaturity of the model	X		
Primary care centres are saturated and are not efficient.	X		
It needs to be led by hospital managers rather than departments	X		
Unclear application in the hospital mainstream. Unknown organisational model	X		
Healthcare is growing unorganised, just by individual leadership rather than by organisational planning.	X		
Healthcare professionals need to have access to technology resources	X		
New personnel is needed in healthcare organisations, specialists in technology, to support patients and professionals	X		
Actual healthcare systems are based on acute intervention rather than prevention. Lack of investment in prevention to avoid future diseases	X		
Lack of awareness about the impact of chronic condition in the healthcare system	X		
Difficulties with competencies among organisations involved.	X		
Need to develop new access point to the systems for patients	X		
Private insurance companies do not accept chronic patients	X		
It has to be a transversal project to manage chronic patient and to join services from different departments.	X		
Resources in hospitals are scarce	X		
Unclear about project leadership	X		
Lack of European regulation about common information	X		
Emergencies are not covered	X		
Lack of communication and coordination between healthcare levels	X		
Legal and ethical issues about information privacy and access	X		
Lack of vision in healthcare organisations	X		
Telecommunication and Technology industry do not understand the medical business	X		
Difficult to automate the human part of clinics	X		
Rarely this projects have done healthcare consultation, but data and vital signal communication	X		
Importance of informal relationships	X		
Lack of organisational model to deal with the system and the coordination between healthcare organisations	X		
Inspections from health authorities makes it difficult to conduct pilot projects.		X	
Difficulties with the authorizations for research in the area		X	

Table 6.5 Comparisons of Organisational Barriers

Three organisational benefits were mentioned by the three sources. The first one was to improve the access to healthcare assistance to distance locations or with difficult access. This is particularly important in rural areas with low demographic index and a common telemedicine application. However, it was not relevant in our case studies as patient lived in the influence area of two large cities. Secondly, the increase of access to specialist expertise was reported. This benefit can also be categorised as a professional benefit. However, it is also organisational because it can help to improve the use of resources and improve diagnosis from primary care. The last benefit mentioned by all sources was to increase the collaboration between healthcare professionals. These systems support a model in which healthcare services are provided in an integrated way. They also support formal ways of collaboration.

The benefit mentioned by the literature review: -reduce number of house calls-, is due to the differences in the telecare model that is applied. In Case Study II, patients have access to a call-centre; consequently house calls are part of the routine protocols.

ORGANISATIONAL BENEFITS	Case Study II	Case Study I	Literature Review
Increase accessibility of specialist expertise	X	X	X
Increase medical care in distant places, such as rural areas	X	X	X
Allow collaboration and communication between different healthcare professionals from different levels	X	X	X
Helpful to rationalist the access to different resources	X		X
Improve efficiency and speed up clinical processes. Allow more patients	X		X
Help to reduce access to hospital	X		X
Share information and coordinate clinical interventions	X		X
Help to redistribute the work load	X		X
Multi-pathological patients can have access to different resources in an integrated model. Consider the patient as a whole	X		
A unique access point to the system for patients	X		
Increase use efficiency in scarce resources	X		
Helpful to find out untapped demand of new services	X		
Allow new sanitary models in aspects such as palliative care	X		

Improve the technological level of the industry	X		
Improve research areas in universities	X		
Reduce number of house calls			X
Allow a stronger focus on disease management			X

Table 6.6 Comparisons of Organisational Benefits

6.3.4 Patient-related issues

Tables 6.7 and 6.8 present the patient-related barriers and benefits. The only patient-related barrier reported was the lack of self-management skills in some patients; however, the majority of participants did not report it.

PATIENT-RELATED BARRIERS	Case Study II	Case Study I	Literature Review
Patients have to be responsible for their own health. Lack of self-management skills	X		X
Patients have to trust more in primary care	X		
Not have access to test results	X		

Table 6.7 Comparisons of Patient-Related Barriers

The consensus on patient-related benefits is more evident. Patients are the group of stakeholders, who can obtain the most important advantages. Improving quality of life and patients' satisfaction, their confident and positive perceptions are generally reported. As well, avoiding patients transfer and commuting were also reported in Case Study II and the literature review. In theory, this model allows the patient to be at home and to be frequently treated there.

Moreover, the improvement in the social support was also mentioned. Being treated at home supports independent living and improves the social network of senior citizens. It has a significant impact, even on the areas where they live.

PATIENT-RELATED BENEFITS	Case Study II	Case Study I	Literature Review
Improve patient care, quality of life and satisfaction	X	X	X
Patients get more confident about their treatment & the healthcare professionals	X	X	X
Allow patients be at home and consequently improve the social impact in the area	X	X	X
Gain confidence with the relatives	X	X	
Improve the patient self-management and improve Knowledge of the disease	X		X

Improve access and communication to healthcare assistance at anytime	X		X
Reduce patient commuting	X		X
Feel more accompanied at home-Reduce isolation	X		X
Give better attention to patient with reduce mobility	X		X
Empower patients role	X		X
Improve the relationship with patients	X		
Patients gain autonomy and independence	X		
Can help to localize patients with an emergency or with cognitive problems	X		
Improve of cognitive functions			X
Better control of negative emotions			X

Table 6.8 Comparisons of Patient-Related Benefits

Some of the differences found between the literature review and both case studies, -such as a better control of negative emotions and improvement of cognitive functions- are related to the differences in the projects, very related to psychiatric diseases; which do not apply to any of either case studies.

6.3.5 Professional issues

Tables 6.9 and 6.10 shows the similarities and differences in the professional barriers reported. As it has happened in other categories, all the barriers mentioned in Case Study I were also mentioned in Case Study II. One of those barriers was the necessity of getting used to a different way of working, which is clearly connected with the resistance to change. Another one was the difficulties of doing the pilot projects during overtime and without financial reward. It also connects with the need to be especially motivated about those systems. At this stage most of the work is done by volunteers and based on personal motivation. It was also reported in both cases the need for making healthcare professionals leaders of the projects rather than technology specialist. It would help to overcome resistance to change and improve motivation. However, it was also reported that healthcare professionals tend to be reluctant to new technology.

Moreover, the fear to miss the contact between professionals and patients was also mentioned in Case II and in the literature review. This barrier was related to the change in how patients and professionals interact in a virtual consultation.

PROFESSIONAL BARRIERS	Case Study II	Case Study I	Literature Review
Healthcare professionals need to get used to different way of working.	X	X	X
Difficulties with the extra time that health professionals have to dedicate. Without economic reward.	X	X	X
Most of the projects haven't been lead by healthcare professionals and has been more technology driven.	X	X	X
Power factors between healthcare professionals	X	X	X
Need more involvement and motivation of healthcare professionals.	X	X	
Lack of awareness about telemedicine and its usefulness. It will bring by social pressure	X	X	
Unclear Intellectual property	X	X	
Uncertainty about new technology. Healthcare professionals tend to reactant about technology	X		X
Fear to miss the personal contact between patient and doctor	X		X
Lack of powerful arguments in favour of those systems.	X		X
Change of role for professionals. Nurses empower their role. The patients empower their role in the system	X		X
Most of the work is for nurse and not always is acknowledge	X		
Nurses fear to take decision and assume new responsibilities	X		
Most of the projects are personal initiatives difficult to extend	X		

Table 6.9 Comparisons of Professional Barriers

On the other hand, the possibility of giving access to specialist expertise to primary care professionals was a benefit mentioned by the three sources. Also, changing the way normal practice is conducted was reported as a benefit and as a challenge. It seems that, although resistance to change is a fact, being able to improve actual practice is perceived as a benefit.

Mentioned benefits in both cases were improving relationships between healthcare professionals from different levels and improving the role of nurses.

PROFESSIONAL BENEFITS	Case Study II	Case Study I	Literature Review
Give access to new knowledge, experience and techniques to no specialist healthcare professionals	X	X	X
Make the work more interesting. Changing the way professionals are practising.	X	X	X
Improve relationships between healthcare professional of different levels.	X	X	
Improve the role of the nurses	X	X	
Be a pioneer with the use of technology	X		

Access to new technology, stimulate professionals	X		
Allow new epidemiological research	X		
Allow to discover new ways to categorised patients	X		
Improve the emotional and human side of the work	X		
Improve the access to clinical knowledge to new professionals	X		
Allow new clinical and pharmaceutical research, due to 24 hour access to patient data	X		
Participation in healthcare			X
Agreement with the diagnosis			X

Table 6.10 Comparison of Professional Benefits

6.3.6 Technical issues

The technical barriers and benefits are presented in tables 6.11 and 6.12. As observed in these tables, technical barriers were significantly mentioned and there is a clear agreement about the most relevant. The immaturity of the systems, the need to have accurate systems and the fear of technology failures were mentioned by the three sources. Error tolerance in healthcare is very low due to the importance of accuracy and privacy in health related data.

It was also mentioned the need for paying especial attention to usability issues. Target patients have often little experience with technology and it implies simple and accurate ways of acquiring data.

The lack of standards and the immaturity of mobile communication were mentioned as well. The first barrier is related to the importance of an agreed standard in data codification for all the professionals involved. The second barrier is related to the need for having reliable and 24 hours working communications.

TECHNICAL BARRIERS	Case Study II	Case Study I	Literature Review
Lack of robust commercial solutions. Technology is still immature (Prototypes not fully reliable and operative, do not reflect all the functionality needed)	X	X	X
Concerns about data security, privacy and accuracy. Systems need to work 24/365	X	X	X
Fear to technology failure	X	X	
Patients can have difficulties using the technology. User interface need to be improved. Data capture process has to be simple	X		X

Mobile communication technologies is immature	X		X
Lack of standards in the data codification. Need to use similar codification for all the professionals involved	X		X
Lack of integration with legacy systems. Lack of data integrity	X		
Systems need to integrated. Difficulties due to the use of different systems, quite different between them. Duplicate the work. Lack of universal patient identification. Regional competencies difficult to define a unique standard	X		
Lack of tradition in the use of technology by healthcare professionals	X		
Actual healthcare systems are financial administrative IS, adapted to give medical services. New IS is needed that can be based as medical systems	X		
Systems need to interpret results, professionals cannot process large amount of data. Need for Intelligent systems with high level alarms	X		
Need for a quality control in the systems, they are not considered medical devices and do not pass those controls	X		
Gap between technology and clinics	X		
Resolutions & colour in digital images			X

Table 6.11 Comparison of Technical Barriers

The resolution and colour in digital images mentioned in the literature, did not apply directly to both case studies.

It is worth noting that in Case Study II, the majority reported the need for integration between systems and between the different organisations involved. In all probability, this is because of the complexity of the project and the number of stakeholders involved.

Technical benefits are not especially relevant, apart from the one mentioned by the literature review, which only applied to those systems that are already in the hospital regular services. This stage is not yet reached by both case studies.

TECHNICAL BENEFITS	Case Study II	Case Study I	Literature Review
Have access to cutting-edge technology	X		
Technology can help to do more thing more efficiently	X		
Ensure that patient information is just captured once.			X

Table 6.12 Comparison of Technical Benefits

6.4 Summary

The purpose of this chapter has been to evaluate and validate the proposed framework (BEBAF) and the findings of this research. To fulfil this objective first an evaluation of BEBAF has been conducted using the following strategy: first a detailed explanation of the methods of data analysis has been presented. This has provided a way to assess their effectiveness and the rigour of the process while applied to both cases studies. A theoretical comparison with their precursors – SCOT and Stakeholders- has been then conducted. The objective of this comparison has been to justify the contributions of BEBAF to both frameworks.

A data triangulation has been conducted afterwards, in which, the findings for each category in both case studies and the literature review have been presented and discussed. Results from both case studies and from the literature review are very congruent. In general the most reported benefits of both case studies were also reported in the literature review. The differences found between both case studies and the literature review may be because healthcare systems are different in each country, and these different contexts shape the system and the perception of stakeholders. The differences between the telecare systems under study and the differences between the target patients may also be responsible for those variations.

7 Chapter 7. Summary and Conclusions

7.1 Introduction

In this final chapter the most relevant areas of this research are reviewed. First a summary of the thesis chapter by chapter is presented, followed by the conclusions and discussion. They are classified in the six categories used all along the thesis: clinical, economical organisational, professional, patient-related, and technical issues. The most relevant implications of this research are then reviewed, together with the contributions, limitations and implications for further research. Finally, research and personal reflections are examined.

7.2 Thesis overview

The objective of **Chapter 1** was to set up the background of this thesis with a brief introduction about the definition of e-Health systems and into this category the focus of this dissertation: home-based telemedicine or telecare systems oriented to supporting chronically ill patients. The motivation for this research is based on the low adoption of such systems despite the years of research in the area, and the unclear and complex network of stakeholders involved in the adoption of this technology. A brief introduction about SCOT and Stakeholder theories are then presented and how both approaches can complement each other. The aim is then proposed: " to propose a framework to identify stakeholders involved in e-Health systems and the benefit and barriers to the adoption of such systems". The proposed framework will help to acknowledge the potential problematic areas for the implementation and the adoption of e-Health systems for each actor or social group and to be able to offer solutions based on the potential benefits for each of them."

Chapter 2 presents the academic literature review. The objective of this chapter is to identify the gap in the academic literature. First, the concept of e-Health has been presented, paying particular attention to telecare area and information systems oriented to supporting chronically ill patients. The main conclusions that

arise are that the area is underdeveloped and adoption is still scarce. However, it is generally accepted their potential for cost-reduction and for improving the quality of life in chronically ill patients. A meta-analysis with previous research about benefits and barriers are then conducted, to provide a systematic list of what is already reported. It could be observed limited consensus apart from the most common factors. Finally, the theoretical foundations of this thesis, SCOT, and Stakeholder theories are reviewed. The combination of both approaches is discussed and critically reviewed, paying particular attention to their application in healthcare information systems.

Chapter 3 presents the research approach of this thesis. A brief introduction of the qualitative methods is included, paying particular attention to case study methodology and the interpretivist approach. It also contains the context in which this research has been done, the UK and Spanish healthcare systems. Additionally, the integrated healthcare system proposed by WHO (2002) is explained. The objective is to understand the findings into the hermeneutical circle, inherently related to its context. The data collection strategy is explained, with detail about the sources of data collection for both case studies and the strategy followed for the analysis of the data. This chapter ends with a discussion about the validation methods of any research.

Chapter 4 proposes the benefits and barriers framework (BEBAF). This framework is based on Social Construction of Technology (SCOT) and Stakeholder theories. Afterwards, an exploratory case study conducted in the UK, is presented. The objectives were to identify a preliminary list of stakeholders following BEBAF and a comprehensive list of benefits and barriers to the adoption of such systems. The outcomes are reviewed and classified in six categories: clinical, economic, professional, patient-related, organisational and technical. Finally, the graphical representation of BEBAF is presented and the findings and implications are discussed.

Chapter 5 reviews the case study II. The case study is presented and analysed using the framework BEBAF, defined in chapter 4. The case study is based on the adoption of Motohealth, an Information System developed by Motorola, in

Hospital Clinic of Barcelona, Spain. Following BEBAF, the list of stakeholders identified is presented with a brief description of the role of each of them. The outcomes from the case study are then presented, divided into Benefits and Barriers and classified in the six different categories: Clinical, Professional, Patient-related, Organisational, Economic and Technical. Finally, the graphic representation of the framework is presented. The framework is applied dividing again the findings in the previously mentioned six categories. For each category a map showing benefits and barriers and possible solutions is reviewed.

Chapter 6 evaluates the proposed framework –BEBAF- and validate the findings from both case studies. For this purpose, the use of the framework is discussed with its differences from the original SCOT. The validation of findings is achieved by data triangulation from three sources. Results from both case studies and from the literature review are very consistent. In general the most reported benefits of both case studies are also reported in the literature review. The differences between both case studies and the literature review are likely because healthcare systems are different in each country, and these different contexts shape the system and the perception of stakeholders. Furthermore, the differences between the telecare systems under study and the differences among the target patients might also be responsible for those variations.

7.3 Discussion and Conclusions

In this section, the most important findings and conclusion are discussed. They are divided in the six categories used throughout the thesis: clinical, economic, professional, patient-related, organisational and technical issues. The findings of this dissertation have shown relevant benefits in the adoption of such systems, which could reduce the impact of the reported barriers.

7.3.1 Clinical issues

The potential of telecare systems for improving patients' care, treatment and follow-up is one of the most significant benefits, mentioned by both case studies. With the use of telecare systems communication between patients and healthcare

providers improves and thus the follow-up becomes more continuous and personalised for each patient. This is especially relevant for those patients with comorbidities, of which prevalence in the target patients is high. They can be treated in a more coordinated and holistic way, with collaboration of primary, secondary and tertiary services, as the WHO model proposes (further explanation of the model can be found in Chapter 2, section 2.2). Actual healthcare systems rely on primary care to treat these patients. However, specialist expertise is frequently needed to treat them at some stage. Telecare systems support this model; which, allows treat the patient in a holistic way, and implies formal collaboration, communication and interaction between different clinical levels. It could also imply a reduction in clinical interventions, such as hospital admissions and emergency room visits, due to the potential improvement in the disease evolution. Essentially, the ultimate goal of any healthcare system is to improve the health levels of citizens and those systems have been reported as a tool for achieving this goal. However, demonstrating this benefit is difficult, as mentioned in both case studies. There are limited objective indicators to assess the improvement in the follow-up or in the treatment. It seems that quality of life or other non-clinical variables cannot be strong enough to set-up the evidence. It is more a perception of the stakeholder involved than an objective measurable variable related with the disease.

Its adoption implies a change in the way medical practice is conducted. Virtual interaction between patients and professionals is a challenge for professionals, who fear misunderstanding the symptoms, and who lose some of the information that comes from the context, the informal interaction, the touch, sound and body language of the patient. This lost information need to be gathered in a different way and with a stronger collaboration of the patient. New research is needed focused on how to acquire this information that is missed in a virtual consultation and their importance in the diagnosis. As Collins (1993) highlighted what human and machines are good at is not the same. This distinction lies in the differences between tacit and formal knowledge. Tacit knowledge is located in society and formal knowledge can be encoded into machines. The implications of this distinction are key in trying to automate some of the healthcare professional

activities. Tacit knowledge is not easily replicated in an information system and it might be basic in the success or failure of the system.

Another key implication is the democratisation in the provision of healthcare services. The potential for improving the use of clinical protocols was reported as a benefit. Telecare systems could contribute to follow common guidelines, and spread their usage. Thus, patients would be treated in a similar way independently of who follows them and how they access the system. On the other hand, it clashes with the reality in which there are limited common clinical guidelines for the healthcare organisations involved in the system. Common clinical protocols are still not fully accepted for the entire medical community, due to the different criteria of different healthcare organisations and the lack of evidence-based data for all the diseases. Clinical protocols or guidelines need to be discussed and compromised for a larger number of organisations and professionals involved in a healthcare area. Moreover, allowing professionals to apply their own criterion needs to be considered with some flexibility and the information systems need to support this flexibility.

An important contribution of the adoption of such systems is to have access to continuous data about the patients' vital signals, and to improve the understanding of the optimum clinical model; as reported by hospital researchers and healthcare authorities. Both benefits can facilitate new areas of epidemiological, clinical and technology research, providing new variables to objectively measure the improvements. Access to this information can provide a better understanding about how particular diseases evolve and how different treatments affect this evolution. Moreover, this information could also prevent acute situations before they occured and consequently might allow for a better evolution. Though this implication is still underdeveloped, it could provide 'truly scientific outcomes' to overcome barriers related to the insufficient evidence of the expected benefits.

Some of the solutions to these challenges are that actual research must set a special emphasis on trying to demonstrate the perceived clinical benefits of the implementation of telecare systems. To demonstrate the efficiency and the

improvement in patients' treatment, new variables and methods need to be identified.

7.3.2 Economic Issues

Economic issues are of special relevance according to the findings of both case studies and the literature review. The cost to set up a new telecare service for a geographic area was reported as a relevant barrier by the majority of participants of both case studies and the literature review. This issue faces several implications. In the context of public, universal healthcare provision, it implies that the system needs to be available for the whole set of target patients, increasing initial investment considerably. However, a relevant number of stakeholders have reported the potential of e-Health systems for saving costs through reduction in clinical intervention, in particular: hospitalisation and emergency room visits. Ideally, this potential savings can compensate the initial investment. However, the cost-effectiveness is still not clearly proven, making it difficult to justify the investment from an economic viewpoint. Moreover, the following stakeholders with managerial responsibilities: hospital manager, medical director, IS manager, Healthcare authorities and ERP manager, mentioned that savings at hospital level could suppose a redistribution of new resources over primary care. The argument is based on the idea that reducing hospitalisation could imply the need for more healthcare resources in primary care to treat patients at home. Consequently, new investments could be needed in new areas. More in depth cost-effectiveness studies are needed in which all the areas involved are analysed. As a hospital manager reported: -We have numerous necessities and a restricted budget for new investments. We need to buy washing machines, before buying videos-.

Another possible solution for the funding challenge could come from sharing the cost with the patients. When asked in the questionnaire about sharing the payment, the majority of patients (81,5%) agreed to partially paying for this new service. However, some of them have a small income and are used to having access to free healthcare services. In addition, key stakeholders as healthcare authorities and hospital managers stressed during the interviews that this measure

could be considered unpopular from a political perspective and hence difficult to implement.

Another issue of importance is the necessity to establish reimbursement policies. Actual public healthcare systems have no fees policies for virtual consultation or virtual care. Consequently, those services are actually provided for free. These new types of services need to be reimbursed, especially for possible services provided by private healthcare companies. This issue implies establishing a new economic model that could also pay for virtual services, such as virtual consultation or virtual vigilance of health status of patients.

7.3.3 Patient-Related Issues

Patients normally have a very positive view of the system. Probably, their expectations are based on their previous experience and because Spanish health systems has considerably improved in a short period of time. These new healthcare services based on telecare systems are a relevant improvement over the conventional way. Actually, this group of stakeholders are the most in favour of the adoption of such telecare systems.

On the other hand, the usage of telecare systems implies a sense of self-responsibility over their own health. The role of the patients is improved and they become an active part of the team. They improve their knowledge of the diseases and their self-management skills. This implies that patients often follow the healthcare recommendations better regarding life style, exercise and eating habits and care more for themselves. Also treatment compliance improves and this has direct influences over their health status, which normally improves. This benefit was mostly mentioned, together with the improvement in patients' quality of life and satisfaction. At the same time, they improve their access and communication of healthcare assistance, making it easier to gain access and to develop trust relationships with healthcare professionals.

7.3.4 Professional-Related Issues

Getting access to new knowledge and experience for non-specialist healthcare professionals was the most frequently mentioned benefit, which will also lead to improve the relationships between them. However, it is worth noting that the stakeholders who mentioned it were all specialists. Although this is an advantage for primary care professionals, there are also other priorities. One of them is the change in the working practices that these systems imply. The adoption of these systems implies a different way of relating to patients, most of them virtual ways. Also, it implies a responsibility over the data received. In a normal consultation, data is obtained only when patients visit the healthcare professional. With telecare systems, data needs to be analysed more frequently although the systems could add some intelligent tools to filter the data.

A problem frequently mentioned was that releasing the power to technology is hard for professionals. Part of the healthcare professionals have traditionally been reluctant about technology. This is likely because of the importance of accurate and secure data and the somehow frequent technology failure. Another reason for that is the lack of awareness about telemedicine and a possible success model. At this moment, the adoption is still scarce and the telecare models are still immature.

On the other hand, it makes the work more interesting; improve the relationships between healthcare professionals by establishing formal communication channels. In addition, having access to new technology stimulates to some professionals. Those benefits could help them to get used to a new healthcare model. Furthermore, being a pioneer in the use of technology can also improve acceptance of telecare systems. A possible recommendation could be to open the possibility of participating in research projects to more healthcare professionals. This would lead to a better acceptance of those systems and a better knowledge of what can be obtained.

7.3.5 Organisational Issues

Organisational issues are of great importance to the majority of stakeholders, especially for those with managerial responsibilities. It is likely that the most important implication is that technology needs to fit with actual healthcare organisational structures and cover actual necessities. Although the organisational model proposed by WHO for integrated care of chronically ill patient is desirable; it needs to be adapted to fit into the actual organisational structures. Information systems need to be consistent with the actual healthcare organisations. Healthcare organisations are large, complex and slow in their changes. Decision-making processes in the healthcare area involves many different multidisciplinary stakeholders with different interests and necessities, which makes the changing process complicated and slow.

Moreover, one of the most mentioned barriers was the difficulty of coordination of all the stakeholders involved. These systems often involve more than one healthcare organisation and propose a model in which each healthcare level works coordinated and in collaboration. In theory, it implies relevant benefits for the patient and the professionals, but in practice this model is still immature and consequently it seems to be difficult to apply. Furthermore, healthcare organisations and healthcare professionals are not used to work in collaboration. Their organisational model is often based on individualistic working practices. The implementation of a new information system often requires significant changes in working practices and in information management procedures (Gillies, 1998). This barrier is also strongly related to professional resistance to change. This resistance is based on the previously mentioned issues and need to be carefully addressed. On the contrary tele-care systems have the potential of rationalise working practices and to establish formal communication channels. This would lead to a better and more rational use of resources and to improve efficiency as well as speeding-up of clinical processes. These benefits can facilitate a change in the collaboration model and a better use of healthcare resources.

In addition, research activities in technology have become part of the regular areas of the hospital and are often disconnected from the mainstream services. It makes

it difficult to apply the research into the regular practices. Once the project is finished, the transfer from research to regular practice is not structured. One reason for this is the lack of a team or group responsible for transferring the system into the regular service, once the project is finished and has demonstrated its viability.

7.3.6 Technology Issues

Technology problems are closely related with a need for having robust and reliable solutions. Most of the projects are done with prototypes, and consequently their reliability is not the same as a final commercial solution. As mentioned before, for healthcare activities, accuracy and reliability are crucial. Failures in the system and in the communication between the patients' devices and the professionals' computers are frequent in prototypes and makes it difficult to conduct the virtual processes as planned. It also increases considerably the time and effort that need to be dedicated, with the risk of jeopardising the full project. A possible solution could be to establish few phases to the research process, in which different techniques could be used. The first stage could use simulation technologies and progressively work with prototypes increasingly secure and reliable.

Another issue of particular importance is to be able to connect telecare systems with the actual information systems of the participant organisations. This lack of connection was in the majority reported by the stakeholders that were direct users of the systems. Healthcare professionals need to use different systems with different technologies to record the same data and at worst to get the complete medical record of the patient. It is likely that a possible solution would be based on a firmware application, which could connect different applications with different data standards.

Technology needs to facilitate the work of professionals, however in some projects its use implies extra time and extra work for those professionals, who cannot perceive the system as a facilitator. Information systems in the healthcare context need to be reliable 24 hours, 365 days, due to the importance of the data.

Prototypes need to be carefully designed to avoid resistance among direct users and to facilitate the work instead of increasing it.

In summary, those systems are still in an emergent stage, which makes their adoption difficult into the mainstream services. There are powerful driving forces against their full adoption and on the other hand, they promise important potential benefits for the majority of stakeholders and especially for patients and healthcare organisations. Changing the working practices in this area is a challenge. Medical community is individualistic, and healthcare organisations are large and slow in adopting changes. This thesis however, has unfolded several benefits that could help to reinterpret the advantages of the adoption of such systems.

7.4 Implications

The first and most important implication is that despite the possible barriers, these systems hold the promise of improving the quality of life of patients with chronic conditions and to provide a better control of the evolution of their diseases. Indeed, all the patients involved in the projects were more secure and had better control with the system than without it.

Another important implication is that it is likely that a new economic and organisational model is needed to adopt telecare systems into the mainstream healthcare services. This model could take into account the possibility of making the patient share the payment of those new services. In fact, this possibility was well accepted by the majority of patients.

Another significant implication is the difficulty of transferring research into practice. Somehow, it seems that research activities have forgotten their ultimate goal: investigate new systems that can be translated into practice. The transfer of research into practice needs to be developed further and likely as a separate service to be reassessed by independent reviewers.

An important question is where have to be based those services: primary care or secondary care. Unfortunately, there is not a unique answer and it is highly

dependant on the target patients. Patients with chronic condition in the early stages are actually carried out by primary care; hence it seems the best option to implement the systems there. However, once the deterioration advances these patients need to be treated by specialist care. Perhaps a compromised solution could be the creation of a new, separated service, which could deal with the patients, independently of the stage of the disease and independently of their comorbidities.

The informal and formal relationships among professionals are essential issues. Power, politics and human relationships are as important here as in any other setting. In order to develop a successful system, these issues need to be carefully considered. Especially considering the number of different organisations involved and the political repercussion that healthcare decisions have on citizens.

7.5 Research contribution

This thesis has contributed to the knowledge of the area in several points. They are explained and explored in the following paragraphs.

- First, a new framework (BEBAF) has been designed and reviewed. BEBAF aims to identify the stakeholders involved in the adoption of e-Health systems and to represent the barriers and benefits of the implementation and adoption of e-Health systems for each actor or social group. Finally, it represents possible solutions that could be based on the potential benefits.

This framework has enriched SCOT with a systematic stakeholder identification (Pouloudi and Whitley's framework for stakeholder identification). Also, it represents the benefits of the adoption as well as the barriers, providing a more complete picture of the expected benefits of the technology under study. In addition, it proposes a new way of closure based on the reinterpretation of a barrier in the light of a possible benefit.

- The second contribution of this dissertation is a comprehensive list of potential stakeholders involved in Telecare systems.

This list contributes to a better knowledge of the stakeholders or different participants, social groups, individuals or organisations involved in telecare systems. Who they are and what their perception are and their role in the adoption of such systems, could provide a better understanding of the complex networks of stakeholders in healthcare.

- A third contribution is a comprehensive list of benefits and barriers for the adoption of telecare system for each stakeholder divided into six categories.

During this research, a comprehensive list of benefits and barriers for the adoption of such systems has been identified. Both case studies were representative telecare projects and their outcomes were relevant. These findings would facilitate further adoptions by the acknowledgement of the issues surrounding the acceptance by all the stakeholders involved. The benefits and barriers were classified in the six categories used in the thesis: Clinical, Organisational, Economic, Professional, Patient-related and Technical issues.

- A fourth contribution is the proposal of possible solutions to overcome the identified barriers.

Possible solutions have been defined by the application of BEBAF to the main barriers. Most of these solutions have emerged by applying the closure by reinterpretation of benefits.

- The fifth contribution is a meta-analysis about the benefits and barriers of the adoption of telecare systems reported in the academic literature.

From an extensive literature review about the benefits and barriers of the adoption of such systems, seven relevant review publications have been taken into account and a compilation of their findings has been presented.

- The sixth contribution has been to develop an evaluation method for the findings of this dissertation

One of the challenges of this research has been to evaluate the framework and the findings of both case studies. For this purpose, in chapter 6 an in-depth evaluation has been conducted. The evaluation of the framework has been achieved by, first evaluating their contributions, the application process and their differences with its precursors. The findings were also validated by triangulation of three sources: both case studies and the literature review. This evaluation process could be a basis to be applied in future case study research.

However, this research also has limitations, which are presented in the following section.

7.6 Research Limitations

The proposed framework BEBAF does not reflect the evolution and possible changes in stakeholders' perceptions as time passes. Stakeholders' perceptions can change depending on the stage of the project. This framework however, represents a static picture at a particular stage.

Another limitation is the lack of non-human actors such as the system itself. They are not considered as participants, in line with actor-network theories. This aspect, however, could add new insight of the barriers and benefits for adoption.

Neither is it considered in this framework the fact that some benefits and barriers link or lead to others. Somehow, this linked relationship is important to study the reason for the delay in the adoption and it is not formally taken into account in BEBAF.

Stakeholders reported benefits and barriers that applied directly to their group, but also some issues that applied to other interest groups. It would be beneficial to take into account not only who reported each particular issue, but also to whom it applied.

In addition, only two case studies have been investigated for this thesis due to limitation of time and scope. It would be necessary to conduct additional case studies for a better confirmation of the outcomes. Moreover, systems fully adopted will add a valuable contribution to the area. This limitation implies a limited generalisation of the findings.

From a methodological viewpoint, this research is restricted by the method chosen: case study. This method implies the difficulty of generalising from the results. However, the purpose of this thesis was not to create a general theory but a conceptual framework that could be used in different contexts. It also involves the bias of the researcher. In case studies the researcher often becomes part of the study, although the researcher has tried to minimise the impact of their own opinions from the facts and opinions of the interviewees. Case study often takes a long time and makes it complex to analyse the great amount of documents and texts.

Some of those limitations could be opportunities for new research.

7.7 Areas for new contributions

If the framework had been applied in a different framework, people's perception would have changed. Reflecting this diversity could add new insight in the area. It would be desirable to verify the findings in a different stage of adoption and check which of those barriers would still be there and which of them would not. The same strategy with the benefits would help to highlight which ones were real benefits and which ones were only vague expectations. Comparing the different results would add new insight in how perceptions evolve and what should be expected at any different stage of the information systems life cycle.

Conducting additional case studies in the area could facilitate a generalisation of the outcomes and to confirm the results in other telecare systems. This would help to confirm which benefits and barriers were context dependant and which could be expected in any other implementation.

Additional research could be conducted applying the framework in different contexts and different information systems. Thus the framework would be tested in a different scenario and its value to represent the benefits and barriers validated for different settings.

Methodological triangulation could contribute to a deeper confirmation of the validity of the list of stakeholders and the list of benefits and barriers. The use of an additional research method, such as survey or participants confirmation of results, could facilitate the testing and validation of the outcomes of this dissertation.

7.8 Reflections

During the length of this research few reflections about the research process have arisen, the most relevant are presented in the following paragraphs.

When I started the field research I had great expectation about what the patients and their families could say and contribute. However, I found that their contributions were quite limited about the system and not very valuable. Probably, some reasons for that could be that they identified me with the hospital and it was difficult to break the barrier for them to make their own comments freely. Also their comments were more related to their diseases, their medical symptoms and their personal life than with the systems. Their age and physical condition, sometimes with mental limitations, added an additional constraint. Consequently, I had to look for another strategy to get their input about the system. Although my first impression about the use of questionnaire was negative, I had to admit, that this was the best option to gather their opinions. I learnt in the process that sometimes the best possible option is not the optimum, and real life issues could

clash with the orthodox way of research. In this case, it is necessary to look for alternatives that could provide what we are looking for.

Another important learning outcome from this dissertation is that research activities are not a linear activity that follows a strict plan, although you need one to start with. Research activities are quite similar to information system developing activities; they follow more a circular, disorganised way, in which the different phases overlap. Not until the end of it, the researcher realises that she has learnt how to conduct a research project. It was in this precise moment when I realised that I had learnt how to do it and that I would be able to do it again.

Perseverance is a quality of great help during a PhD, but luckily it could be developed, during the process. You learn and develop your perseverance, because in several occasions, you would need to use it to continue. Many times you should come back and review what you have done before, and compromise with your supervisors some of your work.

Also, I have learnt that serendipity could be a key issue: serendipity to have the opportunity to find a good case study, to find a good supervisor and to be able to continue and finish such a long process. However, perhaps we can also create our own serendipity, by working hard, by using what we have learnt before, by identifying these new opportunities. As Pablo Picasso pinpointed, "Inspiration" does exist, but be sure that it finds you working.

7.9 Personal reflections

Human kind activities have always involved research from the very beginning. It is likely that, research activities are part of our more basic instincts and those ones that make us unique and intelligent. Curiosity, the necessity to get over situations and opportunism are part of the motivators of research and probably the most primitive. Indeed, to discover, conquer and survive are ways of research; or as our ninth century Irish monk said, turning darkness into light. Look for new opportunities and use those ones that arise in front of us, try to add some wisdom in the chaos.

All these reflections motivated me to start. Although this journey has not been linear, I started out very enthusiastic. It was a big goal for me to enrol for a PhD and even more so in an English University. This great enthusiasm lasted for a few months, I went to my first conference and got the best conference paper award and my first paper published. Everything seemed to be aligned, apart from the fact that I was having trouble to start my research. And then the dark hours came. I had to move to another city in another country, start from zero, change my topic, get a high-risk pregnancy and later a beautiful, lovely and extremely time-consuming baby. And after a few more moves and a few more changes and having dealt with data in three languages: English, Spanish and Catalan, I have finally got my research done. It has been a great challenge for me, but also a great opportunity and inspiration.

I am not the same person as when I started. This process has changed me and also has helped me to understand the world in a different dimension. I have learnt a few things and not only academic. Perseverance, patience and tolerance over frustration are some of those. I hope this journey has contributed in making me a better human being.

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Appendix A: Interview questions

Interview about e-Health systems to support chronically ill patients.

- ***Research context:***

Health or telemedicine systems oriented to tele-care of chronically ill patients, mainly in residential and home setting. Usually this type of systems include different health groups. (hospitals, primary centres, residential nursing homes specialists).

1. Date:
2. Respondent:
3. Role:
4. In which type of health centre you usually work (primary centre, secondary, hospital, residential, etc).
5. Please, Could you describe the telemedicine systems in used in your centre?
6. What type of health centres are involved in the system?
7. Have you participate in the definition of the system? How?.
8. What type of influence do you have over the system? In particular, which is your role in the system and how influence it is?
9. Who else is involved in the system? Could you identify other stakeholders or groups involved in the system, and their role and influence?
10. How is the relationship with the other groups? (With whom, how is it, how could be improved.)
11. What type of benefits could you identify from your role in the telemedicine/ e-Health projects?.
12. What inconvenient and barriers or challenges can you identify, also from your role?
13. What would you change if you could?

14. Now in general, what benefits can be obtained from the telemedicine projects, oriented to chronic patients? (Clinical, economical, organisational and technical)
15. What are the inconvenient, barriers and challenges, in general?
16. What are in your opinion the critical success factors?

17. What type of pathologies or diseases can be improved?.
18. What type of pathologies or diseases cannot be improved?

19. What are the reasons for the little diffusion of these systems?
20. What can be done to improve and increase their use?

21. How do you perceived the telemedicine project, in which you have been involved (success or failure) and why?

22. Do you think patients will be keen to pay either partial or totally for the use of these type of systems?

Appendix B: Questionnaire for patients

BENEFITS

Question	1.1.1.	No	A Few	Yes	A Lots
		n (%)	n (%)	n (%)	n (%)
1. Do you expect an improvement in your disease by joining the program?	65	26 (40,0)	4 (6,2)	31 (47,7)	4 (6,2)
2. Do you think you will have better care?	65	2 (3,1)	1 (1,5)	55 (84,6)	7 (11,8)
3. Is a benefit for you to feel more attention?	65	2 (3,1)	0 (0)	54 (83,1)	9 (13,9)
4. Do you believe your disease would be better controlled?	65	4 (6,2)	0 (0)	51 (78,5)	10 (15,4)
5. Is a benefit to be able to contact at any moment with health professionals?	65	0 (0)	0 (0)	43 (66,2)	22 (33,9)
6. Do you think you would visit less the doctor?	65	25 (38,5)	1 (1,5)	39 (60,0)	0 (0)
7. Do you think you would go less to emergency room?	65	21 (32,3)	0 (0)	44 (67,7)	0 (0)
8. Do you think you would stay less in hospital?	65	22 (33,9)	1 (1,5)	42 (64,6)	0 (0)
9. Do you think your life quality would improve?	65	14 (21,5)	5 (7,7)	46 (70,8)	0 (0)
10. Is a benefit for you to have access to cutting edge technology?	65	1 (1,5)	0 (0)	57 (87,7)	7 (10,8)
11. Would be a benefit to have access to the mobile phone for personal use?	65	38 (58,5)	2 (3,1)	24 (36,9)	1 (1,5)
12. Would you feel less isolate at home for participate in this programme?	65	6 (9,2)	0 (0)	54 (83,1)	5 (7,7)
13. is your participation giving you more chance of socialise?	65	21 (32,3)	5 (7,7)	37 (56,2)	2 (3,1)
14. Do you think you would learn more about your disease and consequently would improve your self-care abilities?	65	6 (9,2)	2 (3,1)	54 (83,1)	3 (4,6)
15. Do you think you will improve your role in the following of your disease?	65	9 (14,1)	2 (3,1)	50 (78,1)	3 (4,7)
16. Do you expect savings in time or money for avoiding travels and visits?	65	13 (20,0)	2 (3,1)	48 (73,9)	2 (3,1)
Algún otro beneficio no comentado Any other comment					

CONCERNS OR BARRIERS

Question:	N	No	A few	Yes	A Lot
		n (%)	n (%)	n (%)	n (%)
17. Is a concern for you not to be informed of test result?	65	41 (63,1)	5 (7,7)	17 (26,2)	2 (3,1)
18. Are you concern for not knowing how to use the mobile and the sensors?	65	40 (61,5)	16 (24,6)	7 (10,8)	2 (3,1)
19. Is a concern for you that technology could fail?	65	22 (33,9)	26 (40,0)	15 (23,1)	2 (3,1)

20. . Is a concern for you not visiting the doctor so often?	65	57 (87,7)	2 (3,1)	6 (9,2)	0 (0)
21. Do you think that your disease could be worst controlled?	65	65 (100)	0 (0)	0 (0)	0 (0)
22. Do you think your disesase could get worse?	65	64 (98,5)	0 (0)	1 (1,5)	0 (0)
23. Is a concern for you that a nurse follow you?	65	65 (100)	0 (0)	0 (0)	0 (0)
24. Is a concern for you not to get answer to your calls?	65	49 (75,4)	10 (15,4)	4 (6,2)	2 (3,1)
25. Do you think you could feel more isolate at home?	65	61 (93,8)	0 (0)	4 (6,2)	0 (0)
26. is a concern for you that your personal health record could be lost or shared?	65	45 (69,2)	5 (7,7)	15 (23,1)	0 (0)
27. Do you use a lot the mobile phone for personal use?	65	59 (90,8)	1 (1,5)	4 (6,2)	1 (1,5)
28. Have you any extra expenses for participating in the pilot?	65	63 (96,2)	1 (1,5)	1 (1,5)	0 (0)
29. Would you pay for this services?	65	12 (18,5)	0 (0)	53 (81,5)	0 (0)
30. What would you change in the pilot?	65	52 (80,0)	0 (0)	13 (20,0)	0 (0)
¿What would you change? - The timetable for data transmission - To have a flexible scheduling - the mobile phone coverage - To add comments to the answers to the health-related questionnaire in the mobile phone, not just yes or no. - To do the project longer. - That the project could include home delivery drugs. - Easier data transmission					

Appendix C

Summary of results from selected literature review

1. Aoki, *et al*, 2003
2. Hailey *et al.* 2004
3. Hersh *et al.* 2001; Hersh *et al* 2006
4. Mair & Whitten, 2000
5. Hjelm, 2005
6. Richards *et al*. 2005
7. Ball *et al*. 2001

Outcomes and Methods in Telemedicina Evaluation: (Aoki *et al*. 2003).

(* No tables available)

One hundred and four articles, published from 1966 to 2000, were reviewed to investigate telemedicine evaluation studies in terms of methods and outcomes. A total of 112 evaluations were reported in these 104 articles. Two types of evaluations were evaluated: clinical and non-clinical. Within the clinical evaluations, three were on clinical effectiveness, 26 on patient satisfaction, 49 on diagnostic accuracy, and nine on cost. In the non-clinical evaluations, 15 articles discussed technical issues relating to digital images, such as bandwidth, resolution, and color, and 10 articles assessed management issues concerning efficiency of care, such as avoiding unnecessary patient transfer, or saving time. Of the 112 evaluations, 72 were descriptive in nature. The main methods used in the remaining 40 articles used quantitative methods. Nineteen articles employed statistical techniques, such as receiver operating characteristics curve (three evaluations) and kappa values (seven evaluations). Only one article utilized a qualitative approach to describe a telemedicine system. Currently, there are a number of good reports on diagnostic accuracy, satisfaction, and technological evaluation. However, clinical effectiveness and cost-effectiveness are important parameters, and they have received limited attention. Since telemedicine evaluations tend to explore various outcomes, it may be appropriate to evaluate from a multidisciplinary perspective, and to utilize various methodologies.

(2) Study quality and evidence of benefits in recent assessments of telemedicine (Hailey *et al.* 2004)

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Table 3 Indications of outcomes and quality scores

Area of application	Reference	Indications of effect of telemedicine	Performance score	Study design score	Reliability for decision makers	Economic quality score
Hospital and clinic applications						
Cardiology	6	Cost benefits from use in a prison service	7	2	C	4
	7	Effective in providing specialist paediatric advice	6	1	D	1
Dermatology	8	Cost savings, mainly to patients through avoiding travel	8.5	5	A	
	9		9	1	B	8
	10		6.5	2	C	2
	11[a]		6	1	D	5
	12	Teledermatology more costly	9	5	A	10
Geriatric care	13	Decreased hospitalization	4.5	5	B	8
	14	Lower travel costs	3.5	1	E	5
	15	Fewer falls	4	1	E	
	16	Increased case-load by geriatrician	6.5	1	C	4
Hospice care	17	Cost savings	4.5	1	D	3
Hospital referral	18	Increase in health-care productivity, improved cost-effectiveness	8.5	2	B	8
Infectious disease management	19	Reduced morbidity among HIV-positive prison inmates	7.5	1	C	3
Intensive care	20	Use of off-site intensivist gave decreased mortality and costs	8.5	1	B	6
	21	Use of Internet link to neonatal intensive care unit improved family satisfaction	8	3	B	
Mental health	22	Lower or similar costs using telepsychiatry	5.5	1	D	4
	23, 24		7	1	C	7
	25		5.5	1	D	5
	26	Outcomes better in telemedicine group	5.5	2	C	
Neurology	27, 28	Routine teleneurology less cost-effective than conventional care	6.5	5	A	3
Ophthalmology	11[a]	Cost savings through avoidance of travel	6	1	D	5
	29	Reduction in consults for cataract surgery planning	5	1	D	
Radiology	30	Time savings in intraoperative mammography	5.5	2	C	
	31	Cost savings through avoiding transfer of trauma cases	4	2	D	6
	32	Unclear if transfer of neurosurgery cases improved outcomes	3	5	C	
	33	Improved compliance with practice guidelines	2.5	2	E	
Sleep studies	34	Telemedicine more costly than alternative approach	8.5	3	A	9
Telephone nurse triage	35	Cost savings, encouraged appropriate use of services	8.5	1	B	5
Home-care applications						
Asthma	36	Telephone intervention improved use of inhalers	7.5	3	B	
	37	Reduced utilization of health services	7	3	B	
	38		7	3	B	
Cardiovascular conditions	39	Telephone-based interventions effective for cases of heart failure	8	5	A	3
	40		9.5	5	A	
	41	Benefits unclear for heart failure	5.5	3	C	
	42	Outcomes improved for hypertensives	8	3	B	
	43		8.5	3	A	
	44	Telecardiac rehabilitation as effective as on-site intervention	9.5	2	A	
Diabetes	45	Better glycaemic control	5.5	3	C	
	46		6.5	3	B	
	47		7.5	3	B	
	48	Equal improvement in glycaemic control	7	3	B	
	49	Internet-based approach to self-management feasible but not very effective	9	3	A	
Chronic wound care	50	Improved outcomes and availability of specialist	3.5	1	E	
Obstetrics	51	Improved clinical and economic outcomes in pre-term labour	6.5	1	C	3
Epilepsy	52	Unclear if telemedicine approach to counselling produced different outcomes	7	3	B	
Spinal rehabilitation	53	Telerehabilitation can give long-term clinical and economic benefits	7	3	B	

[a]One study examined both dermatology and ophthalmology.

3: Clinical Outcomes resulting from telemedicine interventions: a systematic review (Hersh *et al.* 2001).

Table 3: Studies of clinical outcomes using interventions of home-based telemedicine.

Outcomes	Quality Score	Clinical Specialty	Sample	Intervention	Effects
Finley-Brennan[29]	I-B	AIDS	57 patients	Social isolation and decision-making skill for home computer network (RCT)	Reduced social isolation when controlled for depression and improved confidence in decision-making with increased use
Gustafson[30]	I-A	AIDS	183 patients	Quality of life and hospitalizations (RCT)	Improvement in active life, negative emotions, cognitive functions, social support, and participation in health care; fewer hospitalizations
Brennan[31]	I-B	Alzheimer's Disease	102 caregivers	Social isolation and decision-making skill for home computer network (RCT)	Improved decision-making confidence but no improvement in decision-making skill or social isolation
Sparks [32]	II-B	Cardiology	20 patients	Comparison of home exercise program with transtelephonic exercise monitoring vs. hospital-based program (RCT)	Both groups improved equally in cardiac function, no medical emergencies in either group
Mahmud [26]	III-B	Chronic Disease	12 patients	Home telecare in chronic disease for frail elderly	Improved compliance and control of disease process; decreased hospitalization and nursing home placement
Nakamura[25]	II-B	Chronic Disease	32 patients	Home telecare in chronic disease for frail elderly	Improvement in activities of daily living, communication, and social cognition
Johnston[24]	I-B	Chronic Disease	212 patients	Home telecare in chronic disease for frail elderly (RCT)	Both groups had comparable medication compliance, knowledge of disease, and ability for self-care
Ahring[17]	II-B	Diabetes Mellitus	42 patients	Home blood sugar monitoring (RCT)	Computer group had HgbA1c drop from 10.6% to 9.2% (-13.2%); control group from 11.2% to 10.2% (-8.9%)
Shultz[21]	II-B	Diabetes Mellitus	20 patients	Home blood sugar monitoring (RCT)	Reduced HgbA1c levels in computer group but details not given
Billiard[19]	II-B	Diabetes Mellitus	22 patients	Home blood sugar monitoring (RCT)	Computer group had HgbA1c drop from 6.7% to 6.0%; control group from 6.8% to 6.7%
Dillisse[22]	II-B	Diabetes Mellitus	20 patients	Home blood sugar monitoring in gestational diabetes (RCT)	Computer group had HgbA1c drop from 6.4% to 5.0%; control group from 7.1% to 5.7%
Frost[23]	II-B	Diabetes Mellitus	21 patients	Home blood sugar monitoring in gestational diabetes	Computer group had HgbA1c drop from 6.1% to 5.4%; control group from 6.2% to 5.7%
Marrero[16]	I-B	Diabetes Mellitus	106 patients	Home blood sugar monitoring (RCT)	Computer group had HgbA1c rise from 9.4% to 10.0%; control group from 9.9% to 10.3%; no difference in ER visits, psychological status, or family functioning
Meese[20]	II-B	Diabetes Mellitus	28 patients	Home blood sugar monitoring (RCT)	Computer group had HgbA1c fall from 9.5% to 8.2% vs. 9.5% to 8.6% for control group
Biermann[18]	II-B	Diabetes Mellitus	46 patients	Home blood sugar monitoring (RCT)	Computer group had HgbA1c fall from 8.3% to 7.3% vs. 8.0% to 6.8% for control group
Friedman[27]	I-A	Hypertension	267 patients	Automated patient monitoring and counseling (RCT)	Adherence and diastolic blood pressure improved
Carowright[28]	I-B	Hypertension	99 patients	Anxiety, blood pressure readings, and gestational age at delivery in home vs. hospital-monitored women (RCT)	Comparable levels of anxiety, mean blood pressure, and gestational age of delivery
Gray[33]	I-B	Neonatology	56 patients	Quality of care and hospitalization (RCT)	Trend towards earlier discharge from hospital
Miyasaka[34]	III-B	Pulmonary	10 patients	Amount of unscheduled care before and after installation of videophone access to physician	Reduction in number of house calls (5 vs. 0), unscheduled hospital visits (24 vs. 5), and hospital admission days (22 vs. 10)

Table 4: Studies of clinical outcomes using interventions of office/hospital-based telemedicine.

Outcomes	Quality Score	Clinical Specialty	Sample	Intervention	Effects
Wootton[37]	II-B	Dermatology	204 patients	Need for special follow-up (RCT)	No difference in need for follow-up
Brennan[36]	I-A	Emergency Medicine	100 patients	Patients randomized to local or telemedicine care (RCT)	No difference in ER recurn or need for additional care
Rosenfeld[38]	II-B	Intensive Care	201 patients	Addition of remote intensivist to surgical ICU	Decreases in severity-adjusted ICU mortality (46–68%) and hospital mortality (30–33%). Decreases in ICU complications (44–50%) and ICU length of stay (30–34%).
Rendina[39]	II-B	Neonatology	314 patients	Length of stay in NICU for telemedicine vs. no telemedicine	Length of stay decreased significantly relsed to birth weight
Goh[40]	III-B	Neurosurgery	116 patients	Neurosurgery transfer before and after teleradiology	Fewer adverse events during transfer (8% vs. 32%)
Goh[41]	III-B	Neurosurgery	63 patients	Head injury patients with teleradiology	Fewer adverse events during transfer (6.4% vs. 32.1%)

3'':Diagnosis, access and outcomes: update of a systematic review of telemedicine services: Hersh *et al.* 2006

Table 14 Studies of diagnosis and management for home-based telemedicine

Source	Domain	Purpose	Sample	Number of TM clinicians	Diagnosis or management	Concordance	FTF vs. FTF concordance	Accuracy	Study class
Jenkins, 2001[62]	Congestive heart failure (CHF)	Agreement in findings of CHF patients by home health nurses	Twenty-eight home care patients with CHF	1	Diagnosis	Of 18 items assessed, TM more likely to claim nail colour abnormality and realtime nurse more likely to detect inspiratory wheeze, ankle oedema and pedal oedema	No		II-C
Morton, 2002[63]	Pulmonary function testing (PFT)	Agreement between home and hospital spirometry after lung transplant	PFTs in 22 patients followed for an average of over 1 year	0	Diagnosis			Sens./positive predictive value for 'alarm' episodes were 63/39%	II-C

Table 15 Studies of health outcomes for home-based telemedicine

Source	Domain	Question	Study type	Control	Sample	Results	Limitations	Class
Artinian, 2003[64]	CHF	Does the medication compliance device Med-eMonitor improve care?	RCT	Nine patients with usual care	Nine patients with usual care plus compliance device and Web-based monitoring	No change in behaviours, walking endurance or functional class; improvement in quality of life for monitored group	Small sample size, short (3-month) follow-up	II-B
Benatar, 2003[20]	CHF	Does nurse telemanagement by advanced practice nurse and vital sign monitoring improve outcomes?	RCT	A total of 108 patients with nurse home visit	A total of 108 patients with bantelephonic home monitoring	Lower rate of hospital readmission and anxiety/depression; some Minnesota Living with Heart Failure Questionnaire and self-efficacy		I-A
de Lusignan, 2001[54]	CHF	Does home monitoring of vital signs and video consulting improve care?	RCT	Ten patients with usual care	Ten patients with home telemonitoring	Similar weight, blood pressure, and quality of life.	Small sample size.	II-B
Jaarsma, 2001[65]	CHF	Does home videoconferencing plus electronic auscultation improve care?	RCT	Twelve patients in usual care	Thirteen patients with telenursing care, 12 with usual plus telephone care	Both telephone and telecare had fewer emergency department visits and trends to fewer hospitalizations	Usual plus telephone care of equal efficacy	I-B

Table 15 (Continued.)

Source	Domain	Question	Study type	Control	Sample	Results	Limitations	Class
LaFramboise, 2005[56]	CHF	Does Health Buddy telecommunication device improve care?	RCT	Twenty-three patients with home visit, 26 with telephonic monitoring	Twenty-one patients with Health Buddy, 20 with HB+home visit	All groups improved self-efficacy and symptoms over time but no difference between modalities	Limited follow-up	II-B
Rath, 2004[57]	CHF	Does home monitoring of vital signs improve care?	Pre-post	A total of 118 patients before intervention	Same 118 patients after invention	Reduction in hospital days by two-thirds; near significant improvement in quality of life	Pre-post design means that factors other than telemedicine could have influenced outcome	II-B
Chumbler, 2004[58]	Chronic disease in elderly	Does Health Buddy, monitoring of vital signs and videoconferencing improve cognitive and other function?	Prospective case control	A total of 115 case-matched veterans referred from senior agencies or rehabilitation programmes	A total of 111 veterans enrolled in home telemonitoring project	Improvements in instrumental activities of daily living and functional independence measurement scales	No randomization, groups may have been different	II-B
Kobb, 2003[59]	Chronic disease in elderly	Does Health Buddy, monitoring of vital signs and videoconferencing improve cognitive and other function?	Cohort	A total of 1120 patients receiving usual care	A total of 281 patients receiving remote home care	Remote monitoring group had reduced hospital and nursing home admissions, ER and clinic visits	No randomization, groups may have been different	II-B
Neal, 2004[10]	Chronic disease in elderly	Does monitoring of vital signs directly into EHR improve quality of life and cognitive function?	RCT	Fifty-seven veterans	Forty-seven veterans	Statistically significant reduction in bad days of care, urgent visits, HbA_{1c} OARS cognitive status and functional level	Many other measures showed no difference	I-A
Ades, 2000[60]	Coronary artery disease	Does ECG and transtelephonic monitoring provide comparable outcomes for at-home cardiac rehabilitation?	Cohort	Fifty patients receiving usual care	Eighty-three patients	Exercise capacity, quality of life and complications (none) comparable in both groups	No randomization, groups may have been different	II-B
Bernerson, 2005[61]	Coronary artery disease	Does Health Buddy monitoring improve care?	RCT	Eighteen patients with Health Buddy asking series of questions	Seventeenpatients with routine care	Communication intervention group had higher self-efficacy, similar risk factor adherence and better functional outcomes by SF-36	Relatively small sample size	I-A
Bellazzi, 2003[35]	Diabetes mellitus	Does home glucose monitoring and videoconferencing improve outcomes?	Cohort	Sixty-seven users of diabetes telemedicine system	Sixty-two non-users of system	HbA_{1C} differences not significant but less variance in experimental group	No randomization, groups may have been different	II-B
Biermann, 2002[62]	Diabetes mellitus	Does home glucose monitoring improve outcomes?	RCT	Sixteen patients with conventional care	Twenty-seven patients with home glucose monitoring	Both groups had similar drops in HbA_{1C} levels	Small sample size, un-explained uneven distribution into groups	II-B
Chase, 2003[37]	Diabetes mellitus	Efficacy of home monitoring of blood glucose	RCT	Thirty-three patients receiving usual monitoring	Thirty patients receiving home monitoring	No difference in HbA_{1c} or hypoglycaemic events (although lower costs for experimental group)		I-B

Table 15 (Continued.)

Source	Domain	Question	Study type	Control	Sample	Results	Limitations	Class
Izquierdo, 2005[92]	Diabetes mellitus	Does diabetes education delivered by telemedicine improve outcomes?	RCT	Twenty-two patients with education delivered in-person	Twenty-four patients with education delivered via telemedicine	No change in HbA_{1C} or behaviour goals between groups		
Welch, 2005[93]	Diabetes mellitus	Does home glucose monitoring improve outcomes?	RCT	Twenty-six patients who used modem-equipped glucometers	Twenty-six patients who received usual care	Slightly larger drop in HbA_{1C} for experimental group but not significant	Results obtained from Montori paper, over half of subjects lost to follow-up at 12 months	
Montori, 2004[94]	Diabetes mellitus	Does home glucose monitoring with feedback improve outcomes?	RCT	Sixteen patients with glucometer transmission plus nurse feedback	Fifteen patients with glucometer transmission but no feedback	Significant reduction in HbA_{1C} (8.2 vs. 7.8%), 50 more minutes per patient in telephone time for experimental group		
Artinian, 2001[95]	Hypertension	Does home monitoring and community-based monitoring of blood pressure improve care?	RCT	Nine patients with usual care	Six patients with home telemonitoring and six with community-based monitoring	Drop in blood pressure for both experimental groups statistically significant over control group	Small sample size, short (3-month) follow-up	
Bondmass, 2000[96]	Hypertension	Does home monitoring of blood pressure improve care?	Pre-post	33 patients with uncontrolled hypertension >1 year	Same 33 patients after invention	Significant reduction in blood pressure from average of 154/90 to 141/83mmHg	Pre-post design means that factors other than telemedicine could have influenced outcome	
Rogers, 2001[35]	Hypertension	Does home monitoring of blood pressure improve care?	RCT	Fifty-five patients with usual care	Fifty-six patients with home telemonitoring	Better improvement in mean, systolic and diastolic pressure (mmHg) for home telemedicine (−2.8) vs. control (+1.3)	Clinical significance of improvements in blood pressure not clear	I-A
Mullen, 2000[97]	Lung transplantation	Does monitoring by home electronic symptom diary improve outcomes in patients awaiting lung transplant?	RCT	Fifty-two patients with telephone reporting	Sixty-seven patients uploading electronic diary	Adherence, length of stay in hospital after transplant and survival after transplant identical	Few clinical variables assessed	II-B
Egner, 2003[98]	Multiple sclerosis	Does telerehabilitation programme delivered via video or telephone improve care?	RCT (subgroup analysis)	Seven patients with in-person and 11 patients with telephone rehabilitation	Nine patients with video rehabilitation	Generally equivalent scores over two years on quality of well-being (QWB) scale, Center for Epidemiologic Studies Depression (CES-D) scale and Fatigue Severity Scale (FSS)	Subgroup analysis of larger RCT, small sample size	II-B
Phillips, 2001[99]	Newly injured spinal cord patients	Does video-based rehabilitation improve care?	RCT	Thirty-nine patients with standard intervention, 36 with telephone intervention	Thirty-six patients with video intervention	Video intervention group had significantly higher QWB scale at one year and reduced annual hospital days		I-A
Harvey-Sedna, 2002[100]	Obesity	Does a therapist-led internet support group lead to better weight loss?	RCT	Fifteen patients in control group, 14 patients in therapist-led in-person group	Fifteen patients in therapist-led internet group	Amount of weight loss similar in all groups	Small sample size	II-B

Table 15 (Continued.)

Source	Domain	Question	Study type	Control	Sample	Results	Limitations	Class
Chan, 2003[101]	Paediatric asthma	Efficacy of store-and-forward home video monitoring of inhaler use along with educational Website and adherence monitoring	RCT	Five patients given office-based education	Five patients given home unit for video monitoring and education	Small non-significant benefits for telemedicine group, with exception of significantly improved peak flow values between 91 and 180 days	Very small sample sizes and differences among them	II-B
D'Souza, 2002[102]	Psychiatry	Does a psycho-educational programme by videoconference after inpatient discharge improve care?	Cohort	Twenty-seven patients discharged to conventional care	Twenty-four patients discharged to care plus programme	Telemedicine patients had higher adherence, lower readmission and lower medication side effects	No randomization, groups may have been different	II-B
Maiolo, 2003[103]	Pulmonary disease	Does home monitoring of pulmonary status improve care?	Pre-post	Twenty-three patients with home monitoring of pulmonary function	Same patients after intervention	Significant reduction in hospital admissions (2.0 vs. 1.0) and acute exacerbations (1.4 vs. 0.63)	Pre-post design means factors other than telemedicine could have influenced outcome	II-B

HbA_{1c}, haemoglobin A_{1c}; SF-36, short form-36

(4) Systematic review of studies of patient satisfaction with telemedicine (Mair & Whitten 2000).

Details of studies of patient satisfaction with teleconsultation in which patient numbers were >20 and methods of measuring satisfaction are explicitly described

Study	Aims in relation to patient satisfaction clearly described	Main outcomes clearly described in introduction or methods	Patient characteristics clearly described	Main findings (simple outcome data including numerators and denominators) reported	Patients representative of entire population from which they were recruited	Patient selection criteria (No of patients)	Study setting	Study design	Results
Allen et al[21]	Yes	Yes	No	No	No	Patients who opted to try telemedicine when bad weather precluded on site visits (39)	Between university medical centre and remote hospital	Questionnaire (5 point Likert scale)	High levels of satisfaction reported at initial telemedicine consultation and at one after on site visit. For all but one of survey items, both initially and on follow up, mean score was 3.0 (positive). Patients found it more difficult to be completely candid on video when asked after subsequent on site

									consultation. 3 physicians saw patients, and satisfaction about ability to communicate with physician during teleconsultation differed in relation to which physician seen. Study too small to pursue observation that satisfaction with telemedicine depended on physician involved
Baigent et al[19]	No	No	No	No	Yes	Random selection from 440 bed psychiatric hospital (63, 41 used telepsychiatry)	State psychiatric hospital	Patients rated satisfaction with interview, methods not specified. Compared inter-rater reliability between 2 psychiatrists (1 observing, 1 interviewing): patients saw interviewer and observer psychiatrist	High level of acceptance among patients interviewed by teleconsultation. More patients found teleconsultations moderately to very enjoyable than face to face interviews (54% setting 1, 95% setting 2, 66% setting 3); most found interview moderately to

								face to face (setting 1), interviewer via telemedicine and observer face to face (setting 2), or both via telemedicine (setting 3)	very interesting (80% setting 1, 95% setting 2, 80% setting 3); most would be happy to have telepsychiatry or even prefer it to face to face interview (60% setting 1, 55% setting 2, 52% setting 3)
Blackmon et al[16]	Yes	Yes	No	Yes	No	Referrals, selection criteria not specified (43)	Between university medical centre and three remote hospitals	Questionnaire (7 point Likert scale)	Minimum of 1 person per family completed questionnaire: 46 adults + 9/16 eligible children responded. All respondents reported satisfaction with teleconsultation: 98% of adults agreed it was as good as face to face consultation. No audio problems, only 1 adult reported visual difficulties. 96% of adults and 8/9 children felt able to talk about

									anything over video system
Brecht et al.[5]	Yes	Yes	No	No	No	Not specified (585)	Between prison and hospital	Questionnaire (5 point Likert scale)	99% response rate. 69% preferred telemedicine. 56% felt equally comfortable with consultant in telemedicine or face to face encounter. 68% felt their medical needs were met better or as well with telemedicine as with face to face contact
Brennan et al[10]	No	No	No	No	Yes	Randomisation method not specified (104)	Between emergency rooms at peripheral and central hospital	Randomised controlled trial. Discussion suggests questionnaire used, but no details of structure	104/122 study eligible individuals participated (85%). 4 patients did not complete protocol (unclear whether telemedicine or control group). No significant differences between groups for overall patient satisfaction,

									positive patient-physician interaction, positive patient-nurse interaction. Telemedicine experience ranked higher than most recent face to face visit to an emergency department
Callahan et al[13]	Yes	No	No	No	No	Convenience sample, selection criteria not specified, exclusion criteria supplied for mental health patients only (93)	Between university medical centre and primary care physician□s office	Questionnaire (5 point Likert scale). Compared satisfaction with medical and mental health applications of telemedicine	Response rates not provided. Mental health consultation patients reported feeling free to talk (mean 4.6), endorsed likelihood of using telemedicine again (mean 4.6), and 57% rated their telemedicine visit as better than face to face. Medical consultation patients scored 4.7, 4.7, and 66% respectively for

									same questions. Mental health consultation patients were just as likely to prefer use of telemedicine for follow up as those seeing other specialists
Clarke[22]	No	Yes	No	No	No	Consecutive referrals (32)	Tertiary psychiatric centre and 3 rural towns	Questionnaire	Response rate 50%. 88% would use service again. 13% felt that service had not helped them understand their problem or develop plan of treatment. 93% reported no difficulties with sound delay or picture blurring
Conrath et al[14]	No	No	No	No	No	Volunteers (32)	Uncertain	Questionnaire. Compared patient perceptions about interactive video with colour or black and white television, hands-free telephone,	Attitudes toward physical presence were significantly more positive than each of 3 remote modes. Preference for the more sensory rich modalities, but not strikingly so

								and physical presence consultation	
Dongier et al[20]	No	Yes	No	No	No	List of last 200 consecutive cases seen by psychiatrists. Consecutive admissions that correlated with proportion of diagnostic categories recruited to study (50). Controls matched for diagnosis, sex, and age (35)	Psychiatric hospital	Case-control study. Questionnaire (5 point Likert scale)	Refusal rate 2%. Most teleconsultations rated "above average" compared with past experience. No significant differences between intervention and control groups in mean scores for any item on questionnaire, but direction of differences consistently favoured traditional consultations
Gilmour et al[8]*	Yes	Yes	No	No	No	GP referrals, no extra details (126)	Between GP surgery and hospital based specialist	Questionnaire (5 point Likert scale)	Response rate 122/126 (97%). 59% felt that teleconsultation was just as good as going to outpatient clinic to see dermatologist, 18% said they felt uncomfortable,

									17% said they were embarrassed using TV link. 96% could hear everything that was said, 94% could see pictures on screen clearly
Harrison et al[17]	Yes	Yes	No	No	No	Feasibility study, no formal selection criteria (54)	Between GP surgery and hospital based specialist	Questionnaire (5 point Likert scale)	Response rate 80%. 84% felt "positive" about using system again. 95% felt "positive" about their teleconsultation. None said they would not teleconsult again
Huston et al[12]	No	Yes	No	Yes	No	Not specified (96)	Between university medical centre and regional medical centre, rural hospitals, primary care clinics, and rural GPs	Questionnaire (7 point Likert scale)	100% response rate. Mean score of 6.8 for statement "Overall, I was very satisfied with today's consultations." 16% stated they would have preferred an in person visit. Researchers concluded that

									participants were very satisfied with telemedicine service
Loane et al[6]*	Yes	Yes	No	No	No	GP referrals, no extra details (334)	Between GP surgery and hospital based specialist	Questionnaire (5 point Likert scale)	Response rate 87%. Overall satisfaction with telemedicine: 85% felt comfortable with it, 96% could talk freely to both doctors during consultation, 97% could hear everything that was said, 93% could see pictures on screen clearly. 16% preferred teleconsultation, and 16% preferred traditional consultation, so degree of inconsistency. Benefits of teledermatology generally recognised: 88% thought it could save time

Lowitt et al[7]	Yes	Yes	Yes	No	Yes	Consecutive dermatology patients (139)	Urban Veterans Affairs hospital, dermatology	Questionnaire (modified 4 point Likert scale). Scenario slightly artificial (only illusion of distance, patient and physician in same building)	7 patients refused to participate: dislike of machines (4), lack of time (2), frustration with skin problem (1). First 6 patients not included in analyses (2 withdrew because of time constraints). Responses positive for 97-100% of video examinations: most preferred video exam by dermatologist to visit in person by non-dermatologist; most preferred to see dermatologist by video close to home rather than travel to see dermatologist in person. Substantial minority preferred on site consultation.

Oakley et al[9]	No	Yes	No	No	No	New patients attending clinic, refusal rate not stated (104)	Hospital dermatology clinic	Questionnaire (5 point Likert scale)	Response rate 94%. Patients impressed with technical quality of process. 74% agreed teleconsultation reduced stress, 80% disagreed that they were embarrassed using it, 54% agreed that it was as good as outpatients, 80% agreed picture quality was good, 94% agreed they could see clearly, 91% could hear clearly; 98% could talk freely; and 97% agreed they were able to ask consultant questions
Pedersen et al[23]	Yes	Yes	No	Yes	No	Patients chosen on randomly selected day (26)	University medical centre and GP surgery at local health centre	6 item questionnaire	Response rate 92% (24/26). 88% would accept a future tele-endoscopic consultation. 96% were satisfied and

									reported more advantages than disadvantages. All patients selected at least 2 advantages of telemedicine: reduced waiting time (23), reduced cost to healthcare system (20), ability to see endoscopic images (18), perception that exam was more thorough (16), excitement with new technology (16). 7 selected at least one disadvantage: did not have proper dialogue with specialist (3), uncomfortable appearing on video (2), uncertain whether specialist understood the problem (1). 18/21 did not believe they would have

									received better treatment if seen on site by specialist
Whitten et al[24]	No	Yes	Yes	No	No	Volunteers. Specific inclusion and exclusion criteria (22)	Between patient homes and remote nurse	Qualitative study (semi-structured telephone interviews analysed thematically)	Patients not particularly concerned about technological issues. 45% of those interviewed suggested that security was its main benefit; 41% saw little health benefit to them personally; 15% identified specific health benefits of being on the system. Participants perceived no difference between talking to nurse in person and talking to her over monitor.

(5) Benefits and drawbacks of Telemedicine: Hjelm (2005)

(* No tables available)

Summary

Telemedicine is a vast subject, but as yet there are limited data on the clinical effectiveness and cost-effectiveness of most telemedicine applications. As a result, objective information about the benefits and drawbacks of telemedicine is limited. This review is therefore based mainly on preliminary results, opinions and predictions. Many potential benefits of telemedicine can be envisaged, including: improved access to information; provision of care not previously deliverable; improved access to services and increasing care delivery; improved professional education; quality control of screening programmes; and reduced health-care costs. Although telemedicine clearly has a wide range of potential benefits, it also has some disadvantages. The main ones that can be envisaged are: a breakdown in the relationship between health professional and patient; a breakdown in the relationship between health professionals; issues concerning the quality of health information; and organizational and bureaucratic difficulties. On balance, the benefits of telemedicine are substantial, assuming that more research will reduce or eliminate the obvious drawbacks.

(6) Remote working: survey of attitudes to eHealth of doctors and nurses in rural practices in the United Kingdom (Richards, et al. 2005)

TABLE 5 *Views about the potential usefulness of eHealth applications*

	Detrimental %	Neutral %	Beneficial %
Scenario 1: GP videoconsulting with specialist (minimum $n = 128$)[a]			
Effect on GP's knowledge and skills	2	15	84
Effect on GP's professional isolation	2	16	82
Effect on access to secondary care	8	19	74
Effect on quality of consultation	22	34	44
Patient privacy	23	64	13
Scenario 2: nurse videoconsulting with GP (minimum $n = 179$)[a]			
Effect on nurse's knowledge and skills	5	25	670
Effect nurse's professional isolation	12	23	66
Effect on access to secondary care	23	32	45
Effect on quality of consultation	27	37	36
Patient privacy	32	52	16
Scenario 3: videoconsulting for education (minimum $n = 187$)[a]			
Effect on ease of access to educational events	2	8	90
Effect on equity of access to educational events	3	12	86
Effect on professional's knowledge and skills	3	16	81
Effect on cost of running educational events	3	17	80
Enjoyment of educational events	50	28	22

[a] The minimum denominator is given. The actual denominator increases in each scenario by up to 4 cases.

(7) E-health: transforming the physician/patient relationship (Ball & Lillis, 2001)

(* No tables available)

Abstract

Healthcare delivery is being transformed by advances in e-health and by the empowered, computer-literate public. Ready to become partners in their own health and to take advantage of online processes, health portals, and physician web pages and e-mail, this new breed of consumer is slowly redefining the physician/patient relationship. Such changes can effect positive results like improved clinical decision-making, increased efficiency, and strengthened communication between physicians and patients. First, however, physicians and the organizations that support them must fully understand their role in the e-health revolution. Both must advance their awareness of the new consumers and their needs and define specific action items that will help them realize the benefits of e-health. Through a combination of timely research and advice, this article will aid them in fulfilling both tasks.