

The critical success factors for IT innovations in Dutch general practices

A systematic literature review



Master Thesis

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Thesis nr.: IKU-0302821

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Abstract

In the last 25 years the demand for health care services has increased rapidly in The Netherlands. In the near future, health care expenses will rise even faster due to ageing and high labor costs. The deployment of IT as a method to save costs is widely accepted. In primary care, the first consultation point in health care, general research to this subject is still scarce. This research attempts to find out which factors determine the success of IT innovations in primary care. An extensive systematic literature review was chosen as a method to find theoretical evidence for the construction of two frameworks, namely stage-oriented (FRAMEWORK A) and actor-based (FRAMEWORK B). After an interview round with practice experts FRAMEWORK B was enhanced, while FRAMEWORK A was discontinued. A second round of interviews focusing on the revised FRAMEWORK B resulted in large support by the experts, though improvements are needed. We conclude that the framework is a good starting point for innovators and researchers to use as a basic guide, while future research must help to extend the framework regarding the innovation type and perspective.

Table of contents

CHAPTER1 – Introduction	11
Health care in the Netherlands	11
Demand	11
Supply	12
Shortage	13
International comparison	14
Dutch health care characteristics	14
Primary care & general practice	15
Demand and supply in primary care	15
Demand and supply in general practice	16
GP density in Europe	17
Other developments in Dutch primary care	17
Primary care & general practice in other countries	18
IT innovations	19
Research question	20
Objective	22
Research execution	22
Systematic literature review	23
Critical success factors & framework	23
Interviews	23
Framework improvements & evaluation	23
Research model	25
Scope & definitions	26
Scientific relevance.....	27
Social relevance	27
CHAPTER 2 – Systematic literature review.....	28
Introduction.....	28
Sources concerning systematic literature review guidelines and protocols.....	28
Background.....	28

The need for a systematic literature review	28
Commissioning the review	29
The review protocol: sources and search queries.....	29
Sources	29
Search queries and keywords.....	31
Documenting the search	32
The review protocol: selection criteria & filtering process	32
Duplicate filter	32
Title filter	33
Results	33
Abstract filter.....	35
Results	35
Access issues.....	35
Content filter	35
Critical success factors, barriers, benefits, ...?.....	36
Comparison with other meta-analyses	36
Classification: from 212 to 23 CSFs	37
Analysis of results.....	38
Background results.....	38
CSF results	42
Merging innovation types	44
CSF distribution over countries	46
CSF distribution over distinctive time periods	48
CHAPTER 3 – Modeling the critical success factors.....	50
Two perspectives, two frameworks	50
FRAMEWORK A: Stage-oriented classification	50
Stages of innovation.....	50
Practical value	51
Descriptions and recommendations	51
Interpreting and using the framework.....	52
FRAMEWORK B: Actor-based CSF flows	53

Project management	53
Actor based (role based) model	53
Interpreting and using the framework	53
FRAMEWORK A & B comparison	54
Summary	55
CHAPTER 4A – Expert interviews	56
Two interview rounds	56
Guidelines and rules for interviews	56
Interview candidate selection	56
Interview design	57
Interview execution	57
Interview analysis	57
Interview sessions	58
INTERVIEW SESSION 1: PAZIO, an online portal	59
Basic & additional apps	59
Stakeholders in PAZIO	60
DigiD, a recognizable log-in system	60
Expert profiles	60
INTERVIEW SESSION 2: Health Bridge, a video communication system	61
Benefits	61
Difficulties	62
Stakeholders in Health Bridge	62
Expert profile	62
INTERVIEW SESSION 3: ZAHBA	63
Stakeholders in ZAHBA	63
Expert profile	63
INTERVIEW SESSION 4: VoeDietist	64
Expert profile	64
PART 2: The experts' vision	64
Section 1: Success factors and remarks	65

Section 2: Expert views on CSFs from literature	66
Differences theory and practice	70
Implications for initial FRAMEWORK A and B.....	71
Notable results	71
Reconsidering FRAMEWORK A	72
Framework discontinuation	72
Reconsidering FRAMEWORK B.....	72
CSF reassessment	73
Qualifiers	73
Actors.....	73
Replacing the central object.....	73
Summary & conclusion.....	74
Framework A	74
Framework B	75
CHAPTER 4B – Validation interviews.....	76
Interview candidate selection	76
Expert profiles	76
Senior Expert 1	76
Senior Expert 2	77
Interview design	77
Interview execution.....	77
Interview analysis	77
Interview results.....	78
PART A: Experts on CSFs.....	78
PART B: Experts on final framework.....	79
External actors.....	79
Qualifiers	79
Actors.....	79
Critical success factors.....	80

Additional CSFs	80
Overall impression.....	81
Summary & conclusion.....	81
CHAPTER 5 – Conclusion	83
Answers to the research questions	83
Sub question 1: collecting publications.....	83
Sub question 2: critical success factors	83
Sub question 3: first expert interviews and first validation	84
Sub question 4: framework enhancements and validation interviews.....	84
Limitations	85
Definitions	85
Representation	85
SLR issues.....	85
Implications for practice and future research.....	85
Innovation types.....	86
Perspectives.....	86
Practical use.....	86
Literature	87
Appendix A	94
Legend of content extraction table.....	94
Content extraction table	94
Appendix B	103
FRAMEWORK A: guidelines	103
PHASE 1: Planning & analysis	103
PHASE 2: Design & implementation.....	105
PHASE 3: Use & maintenance.....	106
Appendix C.....	108
Semi-gestructureerd Onderzoeksinterview t.a.v. modelverbetering (Expert interviews in Dutch)	108
Appendix D	111
Semi-gestructureerd Onderzoeksinterview t.a.v. modelverbetering (Senior expert interview in Dutch)	111

Vragen framework.....	111
THEORY RESULTS (1/2)	112
THEORY RESULTS (2/2)	113
PRACTICE RESULTS (1/3)	114
PRACTICE RESULTS (2/3)	115
FRAMEWORK.....	116

CHAPTER1 – Introduction

Health care in the Netherlands

In the last 25 years the demand for health care services has increased rapidly in The Netherlands. Health care has always entailed a great deal of expense for the society, e.g. 12% (\$68.6 billion) of the Dutch GDP in 2005 (Rijksinstituut voor Volksgezondheid en Milieu [RIVM], 2008), but the prospects for the next 20 years show a worse financial trend. Several factors on both the demand-side and supply-side of health care services will cause increasing costs and staff problems in the future. The tendency of these problems certain implications for Dutch health care in general.

Demand

In 1950, the Dutch distribution of age groups showed a traditional population pyramid with a typical triangle shape (Centraal Bureau voor de Statistiek [CBS], 2010a). It relates to a beneficial situation with regard to social security, as there is a relatively small group of elderly relying on health care services. However, since the 1960 the birth rate decreased rapidly and as a result the Dutch median age is rising as time progresses. Between 2005 and 2025, the large postwar generation born between 1945 and 1960 (usually mentioned as ‘baby boomers’) will represent the group of elderly (Figure 1).

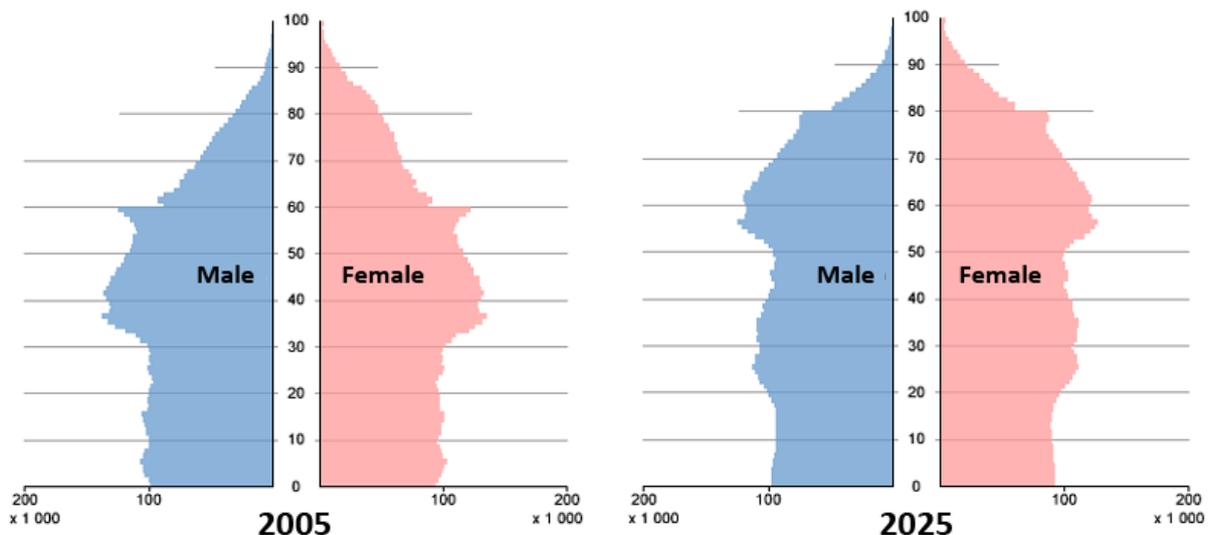


Figure 1 – The process of population ageing in The Netherlands between 2005 and 2025, derived from CBS (2010a, 2010b).

This development of ageing embodies two aspects, namely a demographic shift of the baby boomers towards the retirement age, but also a higher ageing expectancy (Figure 2). These two characteristics are known as the ageing process (also mentioned as greying) that many developed countries currently experience. One important implication of this development is the increasing demand for health care in general and it imposes the government to act sufficiently on this growth.

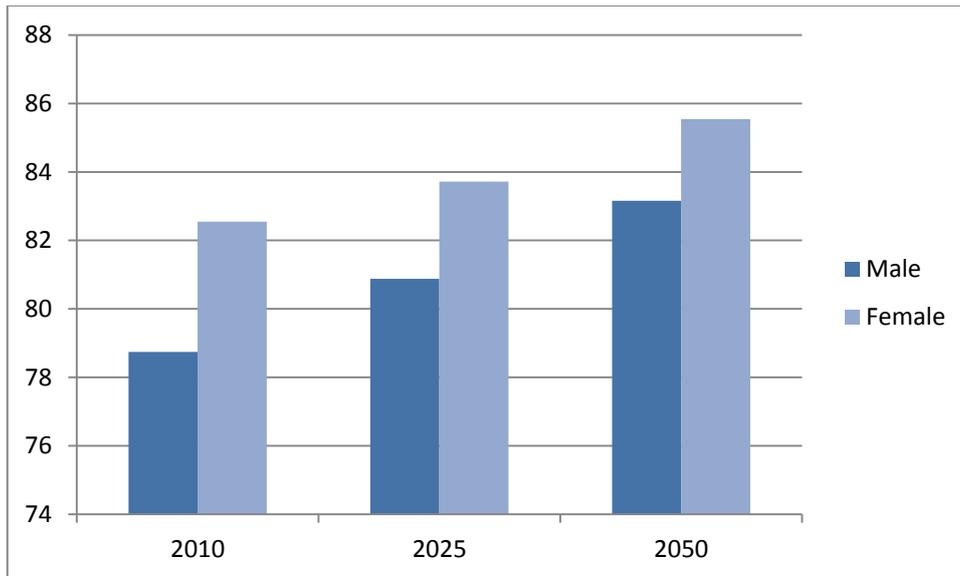


Figure 2 – Life expectancy between 2010 and 2025 (CBS, 2009).

Supply

In the annual Arbeidsmarktbrief 2009, the Ministry of Health, Welfare and Sport (VWS) brought up several aspects of the changing industry, as well as certain implications for the future (VWS, 2009). The letter reports the substantial employment growth (> 50%) in the Dutch health care industry between 1995 and 2008, an ongoing trend due to population ageing and its accompanying health care demand. As a result of this employment, it becomes more difficult to fill all of the vacancies. A side effect is the increasing workload for the current labor force, as it causes certain dissatisfaction and absenteeism on the work floor. Furthermore, the letter elaborates on the current status of the health industry, since the reputation of working in health care is relatively poor due to several tentative reasons, e.g. heavy workload. The media concentrates on these shortcomings, resulting in this negative impression by the audience. The report emphasizes this groundless attitude, as most employees consider their industry as attractive and satisfying. It is a critical issue, because the letter also mentions that the demand for labor will increase with 470,000 in 2025, against a mere 20,000 growth of the entire labor market.

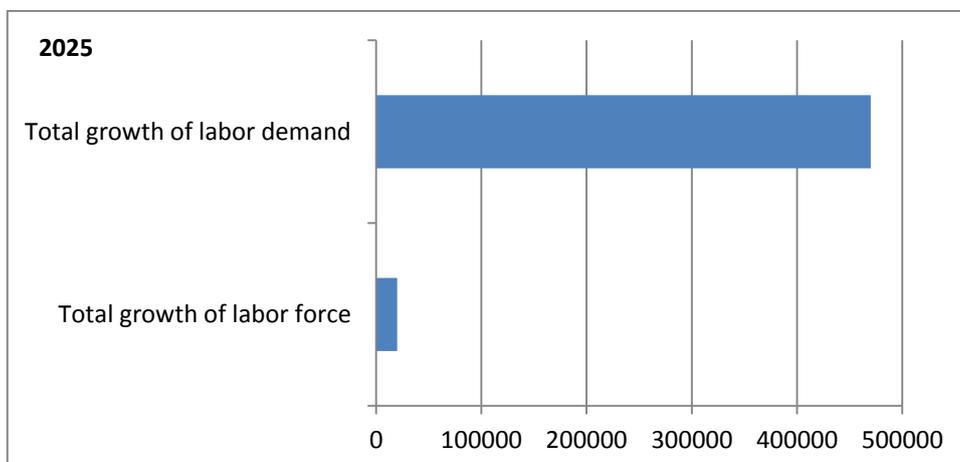


Figure 3 – Key figure of the Dutch labor demand/supply ratio in 2025 (VWS, 2009)

Next to the development on the labor market, there is an important barrier in health care education that prevents many students to participate in medical science: the *numerus clausus* regulation, to be referred to as *numerus fixus* in The Netherlands. This *numerus clausus* is a method to limit the number of students who may study medicine because of high education costs and limited facilities. Obviously, this method disrupts the demand/supply ratio in health care with regard to the increasing demand expectation. Due to this development VWS considers a policy conversion that embodies the discontinuation of the *numerus clausus* in health care in order to stimulate the student influx (Fogteloo, 2010). In addition to the former and current condition of Dutch health care, a research conducted by Prismant (Van der Windt, Van der Velde & Van der Kwartel, 2009) elaborates on the arising dilemmas in the Dutch health industry, e.g. keeping young employees in the organization, offering a sufficient number of internships, encouraging employees to prolong their working life, the placement of unemployed workers, and investing in Human Resource Management. Although no distinct answers are given on each dilemma, the authors tend to focus on solutions concerning the staff problem and innovations, e.g. advanced domotics.

Summarized, a dangerous trend on the labor market, work pressure issues and the educational barriers imply problems on cost management and recruitments for Dutch health care in the near future.

Shortage

The previous sections showed how the significant gap between labor demand and supply for Dutch health care services will play a key role in the next decades. On the one hand, the demand will increase exceptionally, while on the other hand the supply grows minimally.

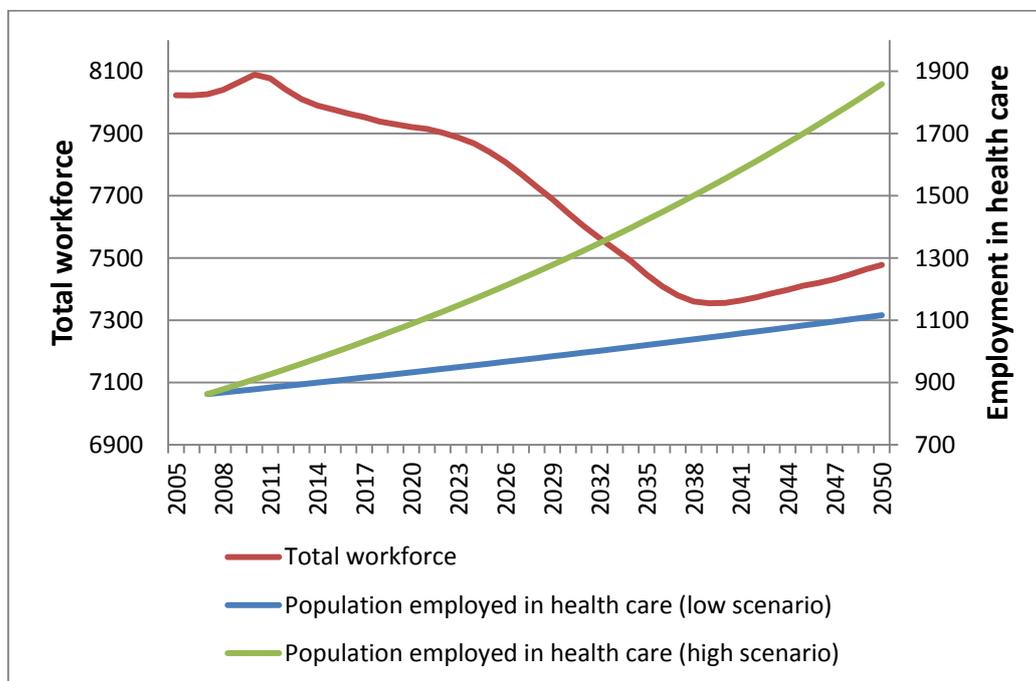


Figure 4 – Prognosis of total workforce and population employed in health care in The Netherlands (CBS, 2009).

Figure 4 contains both the development of the total Dutch labor supply towards 2050 (CBS, 2009) and two projections of possible scenarios on employment in health care calculated by the CPB (Huizinga & Smid, 2004). Until 2011 the Dutch workforce increases, but between 2012 and 2038 the

working population will reduce severely. The scenarios on health care employment are quite uncertain and no unexpected events are considered, e.g. epidemics, political instability and unforeseen crises. The low scenario uses a twelve-monthly growth of 0,6 percent, whereas the high scenario assumes an increase of 1,8 percent. The most probable situation will be somewhere between the two extremes. The decreasing workforce and growing employment (i.e. demand for health services) will cause serious problems on the labor market. Van der Velde and Van der Windt (2010) confirm this projection and they notice the importance of more interest in health care related work. Attention only from recent graduates will not be enough, hence other employed should switch from their industry to health care.

As a result of this trend, ZIP (Zorginnovatieplatform, 2009) considers a reasonable future scenario:

1. Due to the shortage of staff, the salaries in health care will exceptionally increase. More people will decide to find a job in the health care industry and more students will choose a health related study.
2. The aggregate salary increase will trigger much higher medical expenses, causing higher fees in health care. As a result, the demand for health care will decrease as well as the demand for labor.
3. The salaries will increase until the demand and supply will be balanced.

The second point is critical in particular, because VWS's objective to manage the costs and prices in the health care industry carefully appears to become unrestrained.

International comparison

The shortages concern not only The Netherlands. Many Western countries encounter staff shortages in their health care industry, generally due to ageing and lack of interest in health care jobs. For instance, Nevidjon & Erickson (2006) mention the shortage of nurses in the US and its implications for the quality of health care. They also elaborate on some improvement aspects, including image and recruitment of new students. A second example is the shortage of general practitioners [GPs] in Australia (Roach, Atkinson, Waters & Jefferies, 2007), where mainly rural areas suffer from the GP shortage. Next to new recruitments, more time available for real primary care activities instead of additional tasks is a recommendation by the researchers. A third illustration of international staff problems in health care is a study conducted by Bodenheimer, Chen and Bennett (2009) on the increasing number of US citizens with a chronic condition. They emphasize the importance of multidisciplinary teams in primary care as opposed to primary care clinicians or specialists alone. Those are only a few examples of international studies triggered by staff problems in health care, though this subject has been acknowledged worldwide.

Dutch health care characteristics

This research primarily focuses on IT related solutions in Dutch general practice, and prior to the consideration of IT solutions in this primary care field, it is necessary to identify the characteristics of the Dutch health care system. According to Vorstenbosch (2009), three important aspects have changed Dutch health care in the last 30 years. First, a global shift can be noticed from supply driven health care to demand driven health care, i.e. by means of tailor-made medicine, personal budgets and informed consent. Another aspect is the formerly mentioned trend of ageing, while the third aspect concerns an ongoing tendency of innovative changes in management and, above all,

technology. The influence of a technological revolution requires that the integration of practice and technology is feasible. Ethics should be considered as well, e.g. discussing under what conditions technological changes are permitted.

Primary care & general practice

One of the important fields of activity in the health care industry is primary care, a group of workers with which patients initially get involved, e.g. GPs, pharmacists, psychologists, physiotherapists and long-term care. In fact, primary care is the first consultation point for people who need a specific health service. There are several distinctions between the national primary health care systems of Western countries. For instance, The Netherlands draws much attention to a strong primary care system, which resulted in approachable care, good demographic accessibility and strict coordination through the years (De Bakker et al., 2009). On the other hand, some countries encounter difficulties in the establishment of a well-built primary care structure or have a distinctive focus, e.g. Belgium, France, Germany and the US (Maassen, 2005). These differences play an important role in the research approach to innovations within each national primary care system.

General practice is commonly considered as the most important field of activity in primary care in The Netherlands, because the GPs act as a gatekeeper for Dutch health care services (Schäfer et al., 2010). The main tasks for GPs involve (1) acting as a central contact point for their patients, (2) keep track of the overall health situation of each patient, (3) having knowledge of environmental aspects of a patient (e.g. family situation) and (4) being aware of other health services the patient is currently making use of. Besides, GPs must have the analytical capabilities to know whether or not health problems need attention from specialists, i.e. a referral.

Demand and supply in primary care

In order to identify the position and weight of general practice within the entire Dutch primary care industry, it is interesting to consider the different disciplines primary care covers. According to an extended research by Schäfer et al. (2010) on the changes in Dutch health care, the groups of physiotherapists and long-term care have evolved rapidly in the last decade. Since 2006 patients have direct access to services of physiotherapists and currently one-third of patients visit them without referral. As a result, physiotherapy becomes an important channel within Dutch primary care, also because the demand for physiotherapy increases progressively. Long-term care, a collective term for services such as home care, nursing homes and residential homes, is another growing market in health care. For example, the changes of health care personnel between 2001 and 2007 show a growth of 17% in home care and 31% for residential homes. However physiotherapy and long-term care are still relatively small as a primary care service compared to general practice, at least as a primary care service.

In 2010, The Sociaal-Cultureel Planbureau [SCP] published a report on employment estimations until 2030 in Dutch health care, focusing on the nursing and care sector (Eggink, Oudijk & Woittiez, 2010). They indicate a growing demand for personnel in home care, residential homes and nursing homes on an average annual increase in demand of 1,2%, resulting in a total growth of 34% for the coming 20 years. In terms of employment, it amounts a total need of 299,000 full-time equivalents [fte] compared to 222,000 fte in 2005. Although perhaps not all of these care disciplines are covered by primary care workers – home care surely does – it implicates the staffing problems in health care. By

quoting the authors, the interesting question arises “*whether it is actually a good thing for such a high proportion of the labor force to be employed in one single sector*” (p. 90).

Year	Home care	Nursing homes	Residential homes	Total
2005	100	100	100	100
2010	109	108	109	109
2015	118	116	118	117
2020	128	124	127	126
2025	137	131	136	134
2030	146	139	145	143

Table 1 – Demand for personnel in 3 care and nursing disciplines, based on a fixed index points from 2005.

Demand and supply in general practice

The staffing situation for general practice is similar to the cure and nursing sector. According to research by Hingstman and Kenens (2010), the number of GPs has increased with 15% between 2000 and 2010 in The Netherlands. Although this percentage gives the impression to provide a decent growth, it is primarily caused by the increase of female GPs. The average fte quotient differs between the genders in 2010, namely 0.89 fte for males and 0.64 fte for females. A trend of more part-time working female GPs indicates that a problem on primary care supply is rising (Maiorova, Stevens, Van der Zee, Boode & Scherpbier, 2008). On the contrary, the number of inhabitants per fte decreased through the years, which means the population growth has largely been compensated. However, does it necessarily mean that the demand for care decreased either? Measurements by CBS (2011) show that the number of care episodes per 1000 inhabitants increased from 275 in 2002 to 298 in 2010, a raise of 8,4%. Also, the ageing process (i.e. the part of the population above 65 years) in The Netherlands increased from 13,9% in 2000 to 15,3% in 2010 (Eurostat, 2011), which makes an increase of care demand fairly reasonable (The Nederlandse Zorgautoriteit, 2009). The effects on the practitioner’s workload and working hours are also indeterminate, hence it is important to take these issues into account. Summarized, less patients per GP seems a promising trend, but premature conclusions are not wise due to ageing (i.e. more care demand) and workload uncertainties.

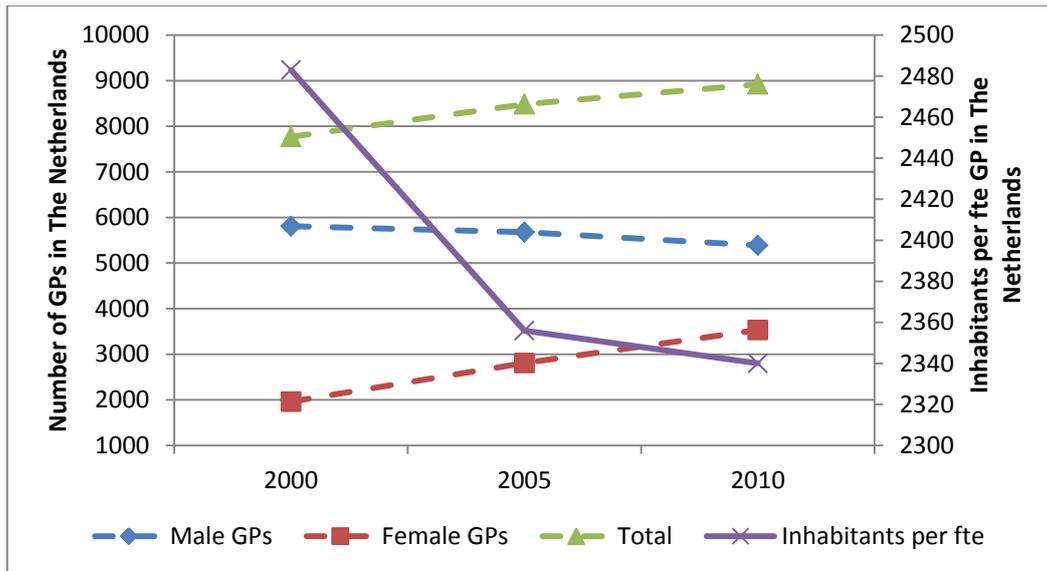


Figure 5 - GP employment in The Netherlands, derived from Hingstman and Kenens (2010). The dashed lines visualize the growing number of GPs, primarily caused by the increase of female part-time GPs (left y-axis). The solid line represents the trend of the average inhabitants per fte GP, which clearly decreased through the years (right y-axis).

GP density in Europe

European primary care statistics by OECD (2011) show that for each 100,000 Dutch inhabitants, 72 GPs were active in 2008. In comparison, Belgium, France and Austria have approximately twice the density, while the UK, Spain, Germany, Denmark and Switzerland are at an equal level as The Netherlands.

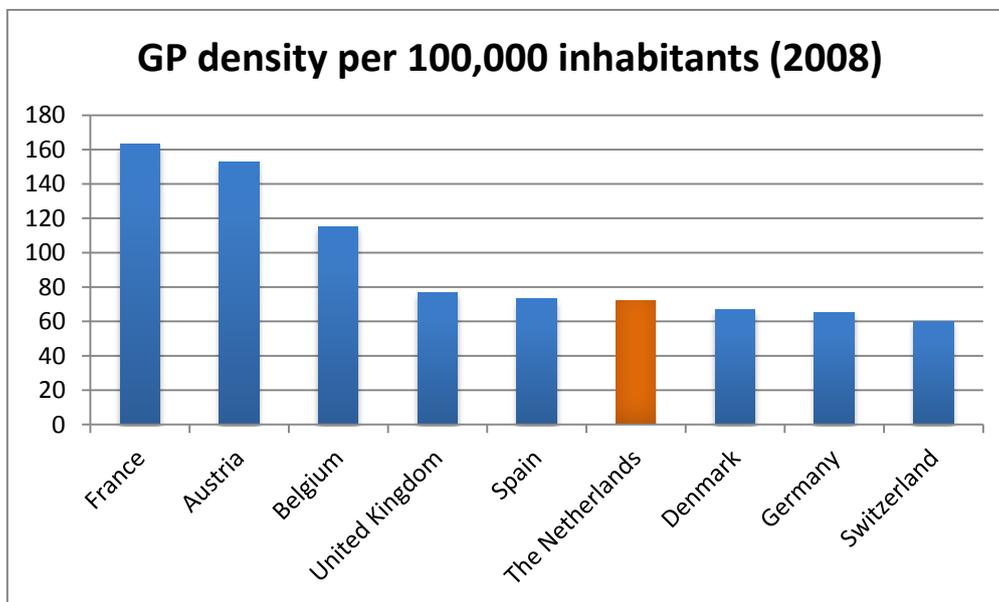


Figure 6 – Density of GPs per 100,000 population (head counts) (OECD, 2011).

Other developments in Dutch primary care

In addition to health care developments in general, De Bakker (2009) addresses several evolutionary processes in Dutch primary care. One important occurrence involves the alteration from local general practices to larger multidisciplinary health care centers, which is consistent to the vision of

Bodenheimer et al. (2009). Currently, there is a high-density network of general practices, serving patients on both preventive and curative purposes (Nielen & Schellevis, 2008). These practices are the 'gatekeepers' for secondary care (Schellevis et al., 2004), as approximately 8% of all patients receive a referral during a GP consult, e.g. ENT or oncology. Furthermore, GPs are to a greater extent assisted by nurse practitioners and therefore a general practice is able to treat more patients than before. Finally, De Bakker mentions the importance of an electronic medical record [EMR] in Dutch health care, because it encourages collaborations between health care practitioners and allows to conduct research on patients data.

Primary care & general practice in other countries

Every Western country has its own health care structure with a different approach regarding primary care and general practice. Hence, the role of general practice varies between developed countries, but in general a strong primary care system comes along with an important position of GPs in the system. Many countries reconsidered their health care system recently because of increasing costs, and as a result a number of them (e.g. UK and the US) are at the point of transition of the entire health care system. The approach is to capitulate some key points of foreign primary care systems.

In the UK, primary care has always held a strong position in health care. Particular consortiums (Primary Care Trusts [PCT], created by the National Health System [NHS]) offer primary care services and concern secondary care establishments. Essentially, they represent the smaller organizations that provide health and social care services within the PCT region and make sure that they work effectively (NHS, n.d.). Currently, the UK is in a process of changing the primary care system, as GPs will get more authorities for medical treats (Ramesh, 2010), and where GPs can purchase health care services at hospitals. In fact, the British government makes primary care more important by reinforcing general practice services, i.e. the gatekeepers.

In de 1990s, primary care organizations in the US adopted the NHS approach from the UK, by making general practitioners stronger gatekeepers of national health care services. This shift was market-driven without any intervention from the government, but the change was rather a subject of quality improvement than cost reduction (Bindman & Majeed, 2003). However, health outcomes could not catch up with other Western countries, to some extent affected by the high fragmentation of US primary care (Halvorsen, 2008). Since the financial crisis in 2008, many countries including the US are putting much effort in cost savings in the health care industry and consequently, reforms initiated by the government cause new structural changes in the health care system. This novel system provides access to health care services for more civilians due to a new health insurance regulation and therefore general practice requires a strong position as a gatekeeper. Recently, Margolius & Bodenheimer (2010) elaborated on the dramatic change of US primary care in terms of supply and demand. They recognize the quality improvements if patient-centered medical homes can be realized, but it will rather cause a growing demand for health services, hence an increasing work load. They provide several building blocks for practice in the future, namely (1) a paradigm shift from individual to population, (2) saying goodbye to solely face-to-face visits, (3) channeling different patient groups and providing only the service they actually need, (4) a role transition which causes less time spent on non-medical tasks and (5) imbursement innovations.

Furthermore, advocates of primary care and general practice restructuring attracted the attention for health program innovations, such as shared appointments for patients with similar medical

complaints, outsourcing redundant tasks that causes work strain and better usage of communication channels (Rubin, 2010b).

Cullingham, Scott & Lagendyk (2008) compared the primary care systems of five countries, including Australia and Canada. In Australia, primary care is tax financed and there is a focus on interdisciplinary health care teams for large geographical areas. Also, collaborations between general practices are popular in so-called Divisions of General Practice [DGP]. While Australia does not have a national primary care policy, general practice plays a key role in primary care. Canada has a taxation system for health care as well, and also has a similar collaboration structure in primary care. Family Practice Networks [FPN] are groups of GPs offering a specific collection of medical services, with shared responsibilities and information. Participation of GPs in FPNs is not mandatory, but most them joined a network because of better opportunities for good care. These networks are equivalents of health centers in The Netherlands, but differ from regulation perspective. While the Dutch government encourages the establishment of health centers and primary care physicians, in Canada the provinces are the enablers of such policies.

Primary care in Belgium is to some extent controlled by the market, similar to the recent structure change in the UK. Health insurances are less taken for granted than in other countries and patients. Civilians have high responsibility for their own health care and although health insurances exist, there is a large number of private practitioners that do not or only partially accept them (“Health Care System”, 2010). For example, in Belgium it is normal to pay a GP consult with cash at the end of the visit. Recently, the Belgian government started focusing on the strengthening of primary care, similar to the situations in the UK, US and The Netherlands. Collaborations between GPs (i.e. ‘GP circles’) are established to improve quality of care and efficiency (Corens, 2007).

Overall, many countries are currently struggling with high health care expenses and governments realize that a strong primary care workforce can play a key role in the desired cost reduction. In several cases the role of general practice is critical with respect to primary care reorganizations. Some governments maintain a strict regulation with respect to primary care expenses, while other ones prefer pro-market. Besides, health care policy is sometimes managed at nation level, while there are also some examples with a decentralized approach.

IT innovations

IT innovations are widely acknowledged as a way to partially intercept the staff problems by means of applications or records (Anderson, 2006; Van Rijen, De Lint & Ottes, 2009; Van der Windt et al., 2009; Tsiachristas, Notenboom, Goudriaan & Groot, 2009; Van der Velde & Van der Windt, 2010). On the one hand, these innovations can be used to perform better and to work more efficiently as a professional, while on the other hand time savings and hence labor savings can be achieved. Despite this promising development, it is questionable if the Dutch health care industry is well prepared to adopt these innovative solutions. In 2002, the Council of Public Health and Health Care (RVZ) published an advisory report on the adoption of e-health in Dutch health care (Van Rijen et al., 2009). One of their conclusions is that telehomecare (e.g. e-consults) is ‘just around the corner’, however since the publication in 2002 e-health has still not been integrated in Dutch public health, even after 8 years. Another research conducted by TPG approaches health care from a logistics perspective and

one of the suggestions is to implement IT solutions, such as EMRs, in order to provide fluent information exchange and proper quality control within the entire chain (Bakker, 2004).

Obviously, IT innovations are not the only solution to the staff shortage. In 2004, VWS launched Sneller Beter, a program aiming at performance improvements on two priority areas in hospitals (Vos, Dücker & Wagner, 2008a). One of the outcomes is that a balanced focus on the two priority areas logistics and security is needed in order to successfully improve a hospital's performance, where logistics is being considered as the engine of the innovation process (Vos, Dücker & Wagner, 2008b). From this perspective, the patient is the central product travelling through the entire chain and the intention is to let this occur efficiently. Hence, the focus is on patients rather than the different hospital departments. Although Sneller Beter draws only attention to hospitals and not to IT in particular, the vision on logistics can be an interesting addition to innovations in primary care. In fact, IT can be used as an instrument to advance logistics in primary care as well.

As we mentioned before, the employment problem will play a key role in Dutch primary care in the coming years and therefore it is interesting to consider a possible solution using IT innovations. Modernization by means of IT can be a way to reduce workload and improve efficiency and productivity in order to make work easier and/or faster. While many recent studies draw attention to the necessity of innovations at large health care institutes (e.g. Paulus, Davis & Steele, 2008; Djellal, & Gallouj, 2007; Snyder & Fields, 2006), innovations within primary care exist as well. Mannan, Murphy and Jones (2006) conducted a research on the problem whether primary care is ready for e-health yet. They concluded that practice staff already using computers acknowledges the benefits of IT, once there is enough trust in technology. The problem arises for the older health care professionals, a relatively large group nearing the end of their medical careers, because they are not really compliant to innovations. Fortunately, this group becomes smaller as time goes by but for the present, they must be taken into account. In addition, Anderson (2006) provides an overview of possible barriers to implement IT innovation solutions, resulting in a number of difficulties practitioners in the United States expect to encounter, including *“(1) lack of access to capital by health care providers, (2) complex system lack of data standards that permit exchange of clinical data, (3) privacy concerns and (4) legal barriers”* (p. 1). Anderson tends to use the term e-health as an instrument that digitalizes and utilizes personal medical data (i.e. EMRs) and he focuses rather on large health care institutes than practitioners in primary care. Besides, his primary research area mainly concerns the US and is hardly comparable to The Netherlands due to different health care systems and labor force situations. Therefore, it is interesting to determine these barriers and success factors for the Dutch health market.

Research question

The previous section mentioned some example studies of how a well-designed health IT product or service can assist GPs in their daily work, which ideally brings an increase in productivity and efficiency. However, it is unclear if these cases concern exceptional success stories or if they represent a generic and structural trend. In other words, it seems that there is no systematic knowledge about the success of IT innovations in general practice yet. Hence, we have a focus area of this research.

Another trigger comes from the fact that most prominent studies are conducted in the US, which obviously differs from the Dutch health care system. Moreover, most health care related research poorly distinguishes the various types of work fields. For instance, Alkhateeb and Doucette (2009) performed a research on e-detailing (*"Influences on physicians' adoption of electronic detailing (e-detailing)"*) but the actual physician's field of activity remains undefined. Is he a primary care practitioner or a specialist? Or could he be both? In addition, it is interesting to determine the situation of Dutch primary care and general practice in 2011, especially with regard to its IT adoption and usage.

The focus domain is an intersection of three large research areas, namely IT, general practice and economics & management. Obtaining relevant sources about productivity and efficiency gains in primary care is the reason for having economics & management as a part of the research area. The surface where these disciplines cross, is the heart of this research (Figure 7). Each research area has a different view on the research subject, and therefore it is interesting to collect and compare the studies to gain insight into the different perspectives on the research subject. Some typical perspectives and approaches from each discipline on the research subject, including a research example:

- **IT** – Quality and development issues on IT, e.g. technological barriers, electronic health/medical records, GP information systems, health care portals, e-prescribing, e-consulting, etc.
- **General practice** – Securing and improving care and cure quality, e.g.
- **Economics** – Productivity and efficiency measures, e.g. workflow analysis, working pressure, logistic improvements, telephonic availability, etc.

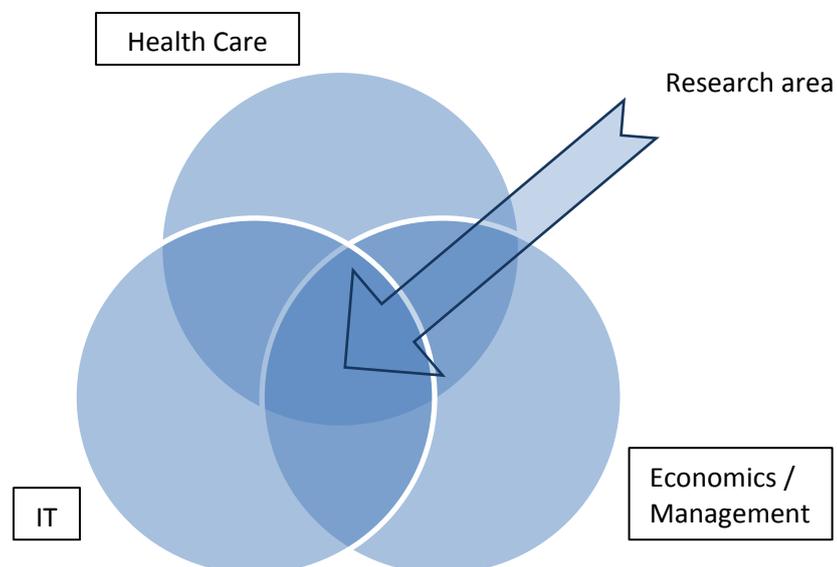


Figure 7 - Visual representation of the research area.

Accordingly, intersection of the 3 research areas creates the opportunity for a multidisciplinary study with the purpose to find what is known about the productivity effects of IT in general practice. With this purpose we are able to determine the general problem statement for this thesis:

Main research question:

“Which critical success factors can be found in scientific literature about IT innovations in Dutch general practice which are developed to improve productivity, efficiency and labor savings and how can this overview be used for a framework that can be used in practice?”

Objective

In this thesis project, the main purpose is to develop a theoretical framework based on the acquired literature, and determine the success factors and barriers of IT projects in Dutch primary care. We use the following phrase:

“Provide insight how IT innovations in Dutch general practice contribute on efficiency, productivity and/or labor savings, determine its relevant critical success factors and develop a framework that can be used in practice”

Research execution

From the previous sections one main research question can be derived, as well as certain sub questions. They are as follows:

- (sub1) *“What publications about IT innovations in general practice focusing on productivity, efficiency and/or labor savings can be found in scientific literature worldwide and in The Netherlands?”*
- (sub2) *“Which critical success factors can be extracted from those publications and how can they be modeled for practical use?”*
- (sub3) *“To what extent can the framework(s) be validated by experts from practice?”*
- (sub4) *“How can the findings from the interviews be used to enhance and complete the framework(s)?”*

In essence, the sub questions represent the different chapters of this research and are the enablers for the answer of the main research question.

Systematic literature review

The first sub question (sub1) refers to the systematic literature reviewing approach by means of an extensive result overview of known studies about IT innovations in general practice, both worldwide and in The Netherlands. It is a good method to get insight into a specific research area of which not much is known (i.e. IT innovations in Dutch general practice). With a systematic literature review we are able to find an answer to the sub question by means of searching, scanning, synthesizing, analyzing, interpreting and assessing existing relevant literature (Centre for Reviews and Dissemination [CRD],2009). The most important aspect of this method is the systematic procedure of the research. The method starts with a deliberate search query based on the research aspects that are analyzed and a database to look into. The next step is to select one or more proper databases to perform the search query on. Subsequently, the filtering and selection process on relevance and redundancy causes a reduction of the collected articles, ultimately leading to a proper selection of related articles from which useful data can be extracted.

Critical success factors & framework

The second sub question (sub2) is an endeavor to determine the critical success factors from the systematic review results. In fact, we will collect and classify as many as possible barriers and success factors obtained from the studies. Based on this overview, it is the purpose to create a framework consisting of general findings and useful statements, serving as an advisory tool for IT innovators in general practice.

Interviews

The next stage involves the projection of the extracted success factors to particular innovations (sub3). We will go into detail on a number of innovations with the purpose to find evident relationships between experiences from innovators and the findings from literature included in the framework. A case represent an IT innovation in general practice of which some useful results and outcomes are available, that can be evaluated. The selection procedure of the innovations will be based on several sources, including:

- Systematic literature review, which provides insight into the existence of IT innovations in general practice;
- A source containing health IT innovations such as the Zorg Voor Innoveren [ZVI], the successor of Zorginnovatieplatform, the Dutch health innovation platform that holds central database of health innovations in The Netherlands;
- Personal network, which is necessary to get in touch with relevant health IT innovators.

Hence, we will perform interview sessions that will serve as a validation opportunity, based on existing and assessable sources. A further specification will be elaborated at a later stage, because depending on the outcomes of the systematic review, the definitive selection can be determined.

Framework improvements & evaluation

The fourth sub question (sub4) consists of improvements and adjustments to the framework owing to the results of the interview sessions. During this stage of the research, an evaluation with a

number of experts will be conducted as well. In fact, it embodies a final evaluation of the framework. For this, we use the three evaluation factors correctness, completeness and consistency (Zowghi & Gervasi, 2002) in order to know the quality of the framework. As the systematic review results and interview sessions are not performed yet, the type and actual number of experts are unknown.

See Figure 8 for an overview of the research execution, including a reference to the sub questions which are covered by the different research parts.

Research model

Figure 8 represents the research model.

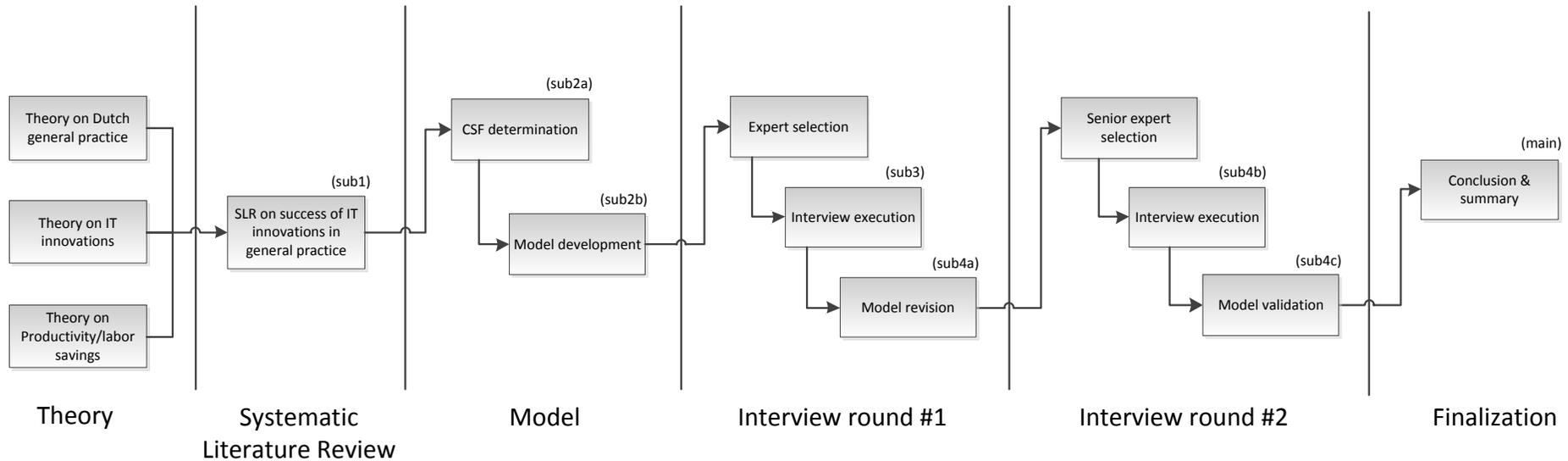


Figure 8 – Global research model. The annotation between brackets above a process (e.g. (sub1)) refers to the particular sub question.

The research model is a summary of the research execution mentioned previously. The theory stage involves the elaboration on the different research fields, after which the systematic literature review will be performed (sub1), resulting in the first deliverable: the CSFs (sub2a). Then, we attempt to model these CSFs in order to give them more practical value (sub2b). During the next part we explore practice by determining and performing the interview sessions in order to find evidence for our previous findings in the framework (sub3), leading to an adjusted and improved version: framework 2.0 (sub4a). Then, we will evaluate it by interviewing senior experts (sub 4b) in order to learn how correct, complete and consistent the final framework is (sub 4c). The final stage is characterized by providing the answer on the main research question, as well as a discussion on the outcomes, limitations and further research and the conclusion.

Scope & definitions

In this thesis several restrictions are being concerned. The research is bounded by the following elements:

1. The results are limited to projects the Netherlands
2. The investigated IT innovations involve only general practice

Second, in order to avoid ambiguity with specific definitions, the following terms are listed alphabetically:

Critical success factor – According to Markus, Axline, Petrie and Tanis (2000) success can be viewed from different dimensions, e.g. the financial manager experiences success when a project does not outrun its budget, whereas a GP thinks a project is successful if he helps and recovers as much patients as possible within the given time. From a business/IT perspective critical success factors concern “areas of business activity where things must go right” (Ward & Peppard, 2002). Performance indicators and the determination of IS/IT thrusts are useful measurement tools with respect to the determination of critical success factors. Next to these particular health care and IT related viewpoints, success can also be measured in terms of satisfaction, expectations and performance. Due to the nature of this research, the definitions by Markus et al. and Ward & Peppard will play a key role, but the third definition will be considered as well.

General practice – General practice is a medical profession involving the treatment of “*acute and chronic illness and providing preventive care and health education for both sexes*” (“General Practice”, 2010).

Grey literature – Debachere (1995) determines grey literature as a body of materials that cannot be found through traditional channels (e.g. publishers), “but which is frequently original and usually recent”. In our research we refer to grey literature as alternative studies not conducted by scientists in particular, but also by commercial and reliant research institutes, such as NIVEL, VWS, Nictiz, etc.

Efficiency – Efficiency refers to the quality and effectiveness as an outcome from a certain task. While productivity rather concentrates on the speed of a task performance and the number of results, efficiency has an emphasis on the quality of each outcome.

IT innovation – Any type of pioneering or revolutionary product or service, based on IT. Such an innovation does not need to be implemented or released, it can also relate to an idea that has not been transformed into a product yet. In this study we will primarily use the term IT innovation, as it is less restricted and less ambiguous than e-health. In this research the following terms are considered as comparable synonyms: **IT project**, **Health IT [HIT]**, etc.

Labor savings – The process of an increase of amount of services a GP provides in a given amount of time, through which less labor is required for the same productivity.

Primary care – The work of health care professionals who act as a first point of consultation or communication for all patients, e.g. GPs, pharmacists, physiotherapists. Primary care should not be confused with primary health care, which is an approach to provide universal health care in developing countries.

Productivity – In this research the reference to productivity is about the ratio of the output to the input of labor. The productivity of a person increases if he is able to perform more tasks in a certain time than before. In this research productivity represents the amount of services a GP provides in a given amount of time.

Scientific relevance

Many research has already been conducted on the success of IT innovations at commercial businesses, e.g. the well-known model by DeLone & McLean (1992, 2003). However, health care is a specific industry that has its largest representation in the public sector, in particular in the case of primary care. This industry should be approached differently than commercial business because its reason for existence does not primarily depend on making profit, but rather on quality performance. For instance, clients judge on their GP by their aid and assistance, not by their consult ratings. Moreover, health care in The Netherlands has its specific characteristics compared to other countries, which makes it more difficult to project the universal DeLone & McLean model on IT innovations in the Dutch health care system. For this reason, we do not use this model as a starting point, but we keep it in mind with regard to a model construction.

Besides, IT innovations in primary care currently exist but they are still in an initial stage and little is known about the quality, efficiency and productivity. This study aims at the creation of a framework that gathers and associates the CSFs from literature that can be useful for innovators in practice. The identification of CSFs benefits in relation to the relatively unexplored research area and it provides new insights into primary care innovations, but also creates opportunities for future research.

Social relevance

The social relevance of this thesis has been addressed in the first section, as it was the actual research trigger. When providing insight into the critical success factors of IT innovations, it becomes easier to focus on the barriers and to take advantage of the transparency when developing IT innovations. Obviously, personnel problems in primary care in terms of shortage affects all people in society, with regard to care quality and increasing costs.

CHAPTER 2 – Systematic literature review

Introduction

As formerly mentioned, the area of success of IT innovations in general practice and primary care has been explored by scientific researchers, but no common results about such innovations currently exist. The number of scientific sources is even scarce with respect to innovations in The Netherlands and for that reason our research approach has two focal points: (1) exploring IT innovations in general practice worldwide, and (2) idem for The Netherlands.

Sources concerning systematic literature review guidelines and protocols

During the stage of systematic literature reviewing the guidelines from the Centre for Reviews and Dissemination [CRD] (2009) and Barbara et al. (2010) are followed. The first book focuses on systematically reviewing medical literature and includes a chapter on economic evaluations, whereas the second report is written from a software engineering perspective. In essence, both sources share to a large extent the same information, where CRD is more detailed and comprehensive. Hence, we will follow the guidelines from CRD as the primary source, while the guidelines by Barbera et al. (2010) will be considered as a useful addition with respect to qualitative research and specific sections, e.g. finding evidence and types of bias. In addition to the last source. Also, the last source is supported by an older report by Kitchenham and Charters (2007) that will be used as well.

Hence, the following protocol execution is primarily based on the descriptions from CRD, but in case the reports by Barbara et al. or Kitchenham and Charters are used, it is specifically mentioned.

Background

Before executing the systematic literature review, a good preparation is needed to avoid errors and bias in the end results. It is also important have a good reason why the review should be conducted. The initial stage contains a number of decisions that must be taken (e.g. the review team), hence it is important to be aware of the choices that are made. Besides, the background of the review ensures that the review remains focused and relevant in the context.

The need for a systematic literature review

As formerly mentioned, a considerable amount of fragmented studies about IT innovations in primary care exist, but a study that collects, compares and analyzes articles on the different success factors and barriers of these innovations has never been conducted before. Discovering patterns and determining importance ratios regarding IT innovations in primary care are good methods to provide insight into the way how GPs can effectively deploy IT in their daily practice. As a result, GPs can work more efficiently (i.e. labor savings), which can ultimately help to reduce the pressure on staff shortage in Dutch primary care. Hence, there is a strong motive for the execution of a systematic review in this research area.

Commissioning the review

The common practice is to have a review team consisting of at least two reviewers, in order to avoid bias and error at each stage. Therefore, this review was commissioned by the author and first supervisor of this study.

The review protocol: sources and search queries

The followed protocol contained the composition of selection criteria and the debate of choices that were made. Subsequently, a selection procedure was triggered, by filtering on (1) duplicates, (2) title, (3) abstract, (4) access, (5) redundancy and (6) article content.

Sources

Five large databases are selected to perform searches:

- PubMed
- Google Scholar
- EconLit (Universiteit Utrecht Library, 2011)
- Scopus
- Web of Science (alias Web of Knowledge)

Google Scholar, Scopus and Web of Science cover a wide range of research fields and are subject of many comparison studies (Falagas et al. ,2008; Kulkarni, Brittainy, Shams & Busse, 2009; Meho & Yang, 2009). Whereas PubMed mainly focuses on medical journals, the database from EconLit primarily exist of economic and business related journals. Both engines were included to represent

Obviously, there are elemental differences between the technical approaches of the five databases. PubMed, EconLit, Web of Science and Scopus is are strict defined databases with an extensive but limited number of included journals. In contrast, Google Scholar is ill-defined with probably the largest but undefined database. Shultz (2007) states that it is difficult make a comparison, because of the different characteristics, approaches and provided information. Most researchers agree on the superiority of PubMed, Web of Science and Scopus over Google Scholar though, especially with respect to the adequateness and quality of the search results. On the other hand, Google Scholar benefits from more full-text citations and the addition of grey literature. Because of the differences and unique features, the databases from each source will be searched in order to acquire a good coverage of existing literature. The main expectation is to get a big overlap within the search results, because Google Scholar, Scopus and Web of Science cover many of the same journals. Though, it will be interesting to see which search engine is able to provide the most relevant results.

Table 2 shows a comparison of the five databases. Summarized, Google Scholar, Scopus and Web of Science cover many research areas, whereas EconLit and PubMed are industry specific. The databases also differ in their approach to grey literature, but also to the presentation of the results. Wolters Kluwer's OvidSP is used to access EconLit, hence some findings refer to that search engine.

Characteristics	PubMed	Google Scholar	EconLit	Scopus	Web of Science
Size & coverage	Over 20 million citations. All articles from “MEDLINE, life science journals, and online books.” (PubMed Help, n.d.). The focus is on medicine and biomedical sciences. PubMed has the most recent database as it includes early versions of articles (Falagas et al., 2008).	“Google Scholar does not publish a list of scientific journals crawled, and the frequency of its updates is unknown. It is therefore impossible to know how current or exhaustive searches are in Google Scholar.” (Wikipedia, 2010). Google Scholar includes sources from any language (Falagas et al., 2008).	EconLit is a comprehensive list of articles, books, and working papers, holding 925,000 records. The database is relatively small compared to the other ones.	As of October 2010, Scopus covers more than 18,000 titles, containing at least 42 million records (Elsevier, 2010). Scopus includes non-English language results (Kulkarni, Brittany, Shams, & Busse, 2009).	The database consists of journals from SCIE, SSCI, A&HCI, CPCI, IC and CCR (Wikipedia, 2011). The database claims to have more than 10,000 journals, including open-access journals and conference proceedings.
Searching & result issues	Only sorts on alphabet, title and author, but not on relevance. Controlled vocabulary (MeSH), possible to perform a journal specific search or filter by author.	Many sorting options, default is on relevance. Inclusion of duplicate citations, secrecy about scholarly definition, no ability to control search controlled vocabulary (Shultz, 2007). For instance, searching for “general practice” also includes results based on “general practices”.	This database is accessed through the health science database Wolters Kluwer OvidSP, which offers many additional sorting options and filters.	A variety of sorting and refining options, including on title, author, year, topic area and affiliation. Specified journal or author searches are possible as well. Unlike Google Scholar, Scopus has no controlled vocabulary, but includes an alternative spelling suggestion.	An extensive way to filter and sort results. The results are to some extent controlled, as searching for “general practic” automatically replaces the wrongly spelled term “practic” with “practice”.
Full-text search	Limited, based on institutional subscriptions (Shultz, 2007).	No agreement between researchers, because Weiss (2009) states that it is completely searchable, while Anders & Evans (2010) only indicate that it is more than PubMed, but not 100%.	No.	No.	No.
Grey literature	No, only peer-reviewed articles are included.	Yes, including theses, technical reports, academic books and similar sources (Google Scholar Help, 2010).	Yes, it contains books, book reviews and dissertations.	Yes, it contains a small selection of scientific books.	Yes, contains books and editorials.

Table 2 – Comparison between the search engines PubMed, Google Scholar, EconLit, Scopus and Web of Science.

Search queries and keywords

Due to the nature of the six databases, we are forced to manage different search queries that are processed by the databases. Since most scientific literature is written in English, the search queries contain only English terms.

Performed search queries	# Results
PubMed (ICT (information technology) computerization) AND ((general practice) (family doctor) (family physician) (family medicine) (family practice) (primary care)) AND productivity AND innovat*	184
Google Scholar (ICT "information technology" computerization) AND ("general practice" "family doctor" "family physician" "family medicine" "family practice" "primary care") AND (productivity AND innovation)	Approx. 5.840 (in fact 1.000 due to Googles restriction)
EconLit (IT OR ICT OR "information technology" OR computerization) AND ("general practice" OR "family doctor" OR "family physician" OR "family medicine" OR "family practice" OR "primary care") AND (productivity OR efficiency)	11, having the option "Include related terms" enabled
Scopus (IT OR ICT OR "information technology" OR computerization) AND ("general practice" OR "family doctor" OR "family physician" OR "family medicine" OR "family practice" OR "primary care") AND (productivity)	156
Web of Science (IT OR ICT OR "information technology" OR computerization) AND ("general practice" OR "family doctor" OR "family physician" OR "family medicine" OR "family practice" OR "primary care") AND (productivity OR innovat*)	100

Table 3 – Database query performed on the five selected databases.

For each search, the three groups as described in the previous chapter (Figure 7) are considered and therefore the keywords are divided into the research disciplines:

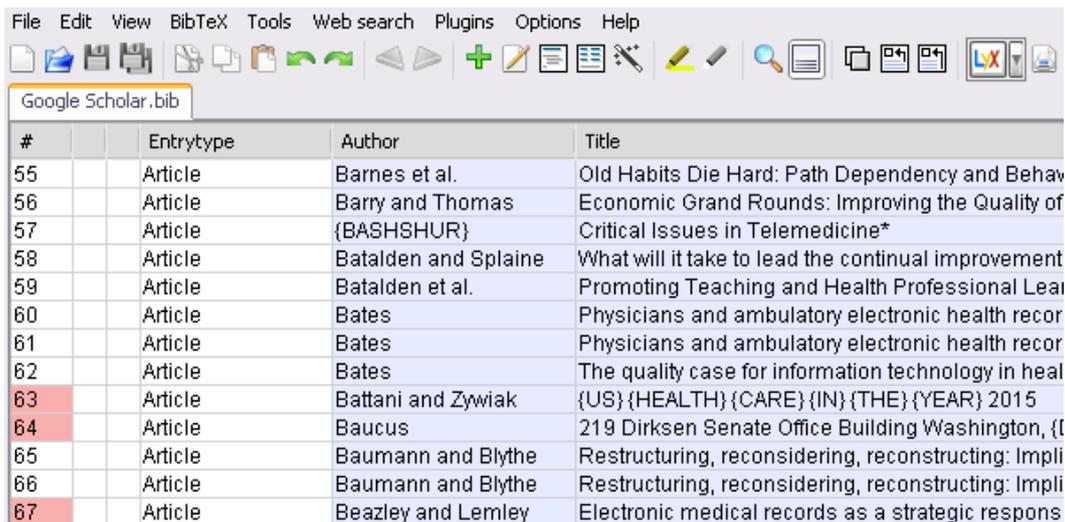
- **IT** – ICT, INFORMATION TECHNOLOGY & COMPUTERIZATION. These terms cover the IT part to a large extent, but unfortunately the keyword IT could not be used in both queries, because the engine included any citation with the expression IT as an article.
- **General practice** – GENERAL PRACTICE, FAMILY DOCTOR, FAMILY PHYSICIAN, FAMILY MEDICINE, FAMILY PRACTICE, PRIMARY CARE. General practice and primary care cover the research area well, but for some countries other terms are used, e.g. family physician in Canada. For this reason, alternative definitions are involved as well. Regrettably, the keyword GP could not be included in order to avoid irrelevant results (e.g. Grand Prix, gross profit and Gaussian process).
- **Economics** – PRODUCTIVITY, INNOVATE*/INNOVATION/EFFICIENCY. The most important keywords with respect to economics are productivity and innovation.

The number of results differs significantly between the searches, but can be explained by (1) less strict results, (2) additional grey literature, (3) more full-text searches with Google Scholar. Although 5.840 appears to be a large number to examine, Google only displays the first 1000 articles in the results, so we were unable to uncover the results 1.001 to 5.840. Fortunately, Google Scholar sorts its results on relevance and for this reason we assume that the most important results made it to the first thousand. The remaining results are nonetheless not shown and therefore untraceable. The search queries for Pubmed, EconLit, Scopus and Web of Science were slightly modified in order to get a sufficient number of records. Consequently, the first review stage generates 1.451 results.

Documenting the search

Before triggering the scan and filter procedure, it is important to manage the search results in a sufficient and transparent way to make sure that other researchers can use them as well. We used two tools to document the results from PubMed and Zotero:

- Zotero, an open-source research browser plugin to collect and organize academic sources. This tool was used to extract the search results to a BibTeX database.
- JabRef, open-source software to manage and export references. This tool assisted in removing duplicates and exporting the results to HTML tables.



#	Entrytype	Author	Title
55	Article	Barnes et al.	Old Habits Die Hard: Path Dependency and Behavior
56	Article	Barry and Thomas	Economic Grand Rounds: Improving the Quality of
57	Article	{BASHSHUR}	Critical Issues in Telemedicine*
58	Article	Batalden and Splaine	What will it take to lead the continual improvement
59	Article	Batalden et al.	Promoting Teaching and Health Professional Learning
60	Article	Bates	Physicians and ambulatory electronic health records
61	Article	Bates	Physicians and ambulatory electronic health records
62	Article	Bates	The quality case for information technology in health
63	Article	Battani and Zywiak	{US} {HEALTH} {CARE} {IN} {THE} {YEAR} 2015
64	Article	Baucus	219 Dirksen Senate Office Building Washington, DC
65	Article	Baumann and Blythe	Restructuring, reconsidering, reconstructing: Implications
66	Article	Baumann and Blythe	Restructuring, reconsidering, reconstructing: Implications
67	Article	Beazley and Lemley	Electronic medical records as a strategic response

Figure 9 – An example of search results extracted from Google Scholar with Zotero and imported into JabRef. The screenshot is from an early stage before duplicates were eliminated and the results were exported to HTML tables.

The documenting process consisted of two basic steps: (1) using Zotero to scan the result pages of each search engine and encode them into a common standard (i.e. BibTeX) and (2) opening this standardized database in JabRef in order to enable easy data completing, sorting and filtering. After this procedure, the remaining database could be exported to a simple HTML-format for better visualization options, e.g. switching abstracts on or off.

The review protocol: selection criteria & filtering process

Kitchenham & Charters (2007) emphasize the importance of well-defined criteria for the selection procedure that follows subsequent to the documentation of the search results. These criteria determine the inclusion or exclusion of the articles at three levels of filtering: (1) title filter, (2) abstract filter and (3) content filter.

Duplicate filter

Some search engines occasionally add redundant citations to the results. There are two types of redundant results: literal duplicates and sources elaborating on the same testing data. During this early stage, only duplicates are caught and removed from the literature database. From the 1.000 results at Google Scholar 97 are duplicates, while EconLit has 1 matching result. The other databases have no duplicates within the own results. The effect is that 1351 articles are screened on title relevance.

Title filter

From this point, the results from all databases are merged with the purpose to avoid bias during the title checkup. Obviously, the title filter is less accurate than the abstract and content filter, as the title provides very brief and selective information about the actual content. The results of the scanning process highly depends on making good and consistent estimations, but determining what is actually 'good' is a complicated issue. We completed this filtering process at our own discretion, by focusing on two aspects:

- Filtering on relevance by making sure that least two of the three research areas from Figure 7 are directly or indirectly involved. An indirect involvement embraces titles without a strong reference to the research areas, though having a relevant journal title which is decisive.
- Performing unstructured rejudgment cycles in order to validate/revise earlier filtering decisions. Random chosen ranges of approximately 50 articles were rejudged and compared. This process intercepts unintentional bias problems such as loss of concentration and mental condition (state of mind).

Results

This first filter procedure leads to the exclusion of 1154 titles, hence 197 articles are still expected to be potentially relevant. The amount of 954 rejections is relatively high and is caused by many irrelevant articles focusing on other health care practices than general practice, e.g. hospitals, specialists or unknown practices. Apparently, these sources conform to the used search queries, but the main subject does not match our research area or are too general. Some real examples that did not pass through the filter:

- Generic, incomplete, untraceable and odd titles, e.g.:
 - *"Top drawer"*
 - *"Todays Top Stories"*
 - *"Healthcare improvements"*
 - *"Towards 2016"*
- Wide scope, e.g.:
 - *"Innovation Diffusion and Implementation"*
 - *"Task Substitution: Where to from here?"*
 - *"Practice-based Interventions"*
 - *"Advances in Health Care Management"*
- Unknown, irrelevant or uncertain health practice, e.g.:
 - *"Hospitalists and ED Patient Flow"*, where the term hospitalist indicates that it is not about general practice or primary care.
 - *"Physicians' Acceptance of Pharmacokinetics-Based Clinical Decision Support Systems"*, questioning whether physicians are linked to primary care or any kind of health professional.
 - *"Integrated Office Technology: How Technology Can Help Improve Office Efficiency"*, which seems relevant at first sight, but the journal is decisive: *"Journal of the American Dental Association"*

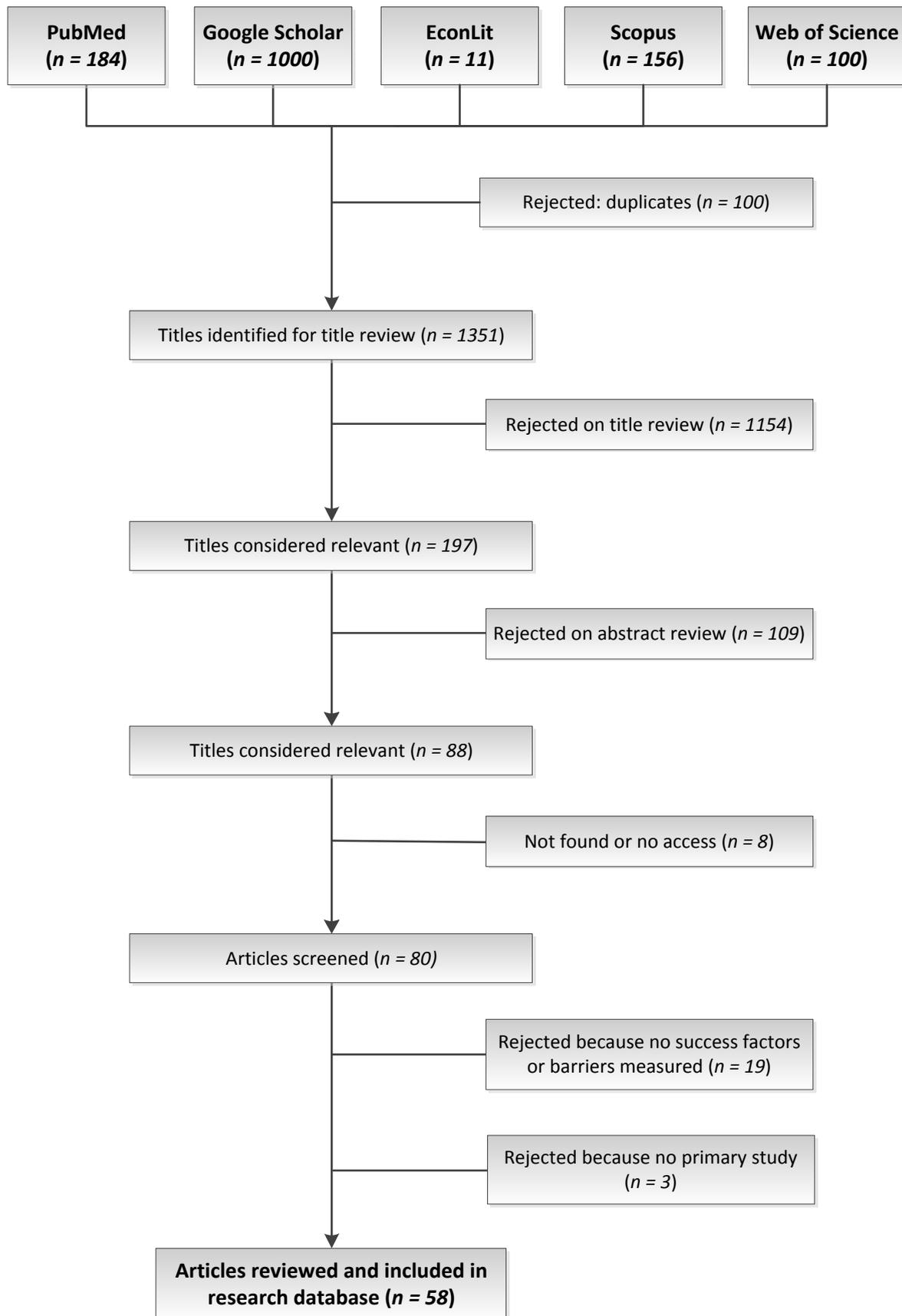


Figure 10 – Search flow for the article selection procedure.

Abstract filter

The abstract filter is a process mentioned by Kitchenham and Charters (2007). The stage helps to identify irrelevant sources prior to the time consuming phase of filtering entire article content. It is a critical step in the review process in terms of bias and reliability as well, because another involved researcher independently scans and filters a sample of the titles left in the literature list. In general, abstracts are available from the source itself or the publisher. In case no summary is obtainable on account of a book chapter or report, two relevant paragraphs are considered as an abstract, e.g. the introduction and the conclusion. The most important ambiguity is about the borderline of health care profession. For instance, the term “primary care physician” is considered to be relevant as GPs hold a strong position in primary care, but in case only the term “physician” is mentioned, we consider it too vague.

Results

From the 197 articles left, 109 are rejected and 88 are considered (potentially) relevant. Most rejected articles include the lack of a critical requirement, namely a mention of general practice or IT. A randomly selected sample of 50 abstracts was being reviewed by the second researcher and shows a conflict on 8 abstracts (16%), where 3 were accepted and rejected by the one researcher and 5 vice versa. During a discussion on the disagreement a 100% consensus was reached on all 50 reviewed items.

Access issues

Due to financial restrictions of the institutional subscriptions (i.e. Utrecht University), eight items could not be accessed, resulting in 80 remaining articles.

Content filter

Kitchenham & Charters (2007) elaborate on the use of a quality assessment as a stage of systematic reviewing. In our situation such quality assessment is of minor importance, since we already decided to deal with grey (i.e. semi- or non-scientific) literature at a preliminary stage. Instead, we use the following two selection criteria:

- Clearly mentioning of CSFs, barriers or similar aspects within the article. No ambiguous or indistinct descriptions are accepted. For instance, if the article includes a vague description of an unhappy system user about which is not much known, we did not apply the label ‘user satisfaction’.
- Only primary studies are allowed, so meta analyses and other systematic reviews are excluded for the CSF extraction. However, these studies are useful with regard to the classification procedure.

Out of the 80 articles we rejected 18 because of absent CSFs and 4 because they concerned systematic reviews. The remaining 58 sources are part of a structured overview of all the useful data that has been extracted (see Appendix A, Table 13). We considered them as 56 individual studies because the study by Protti, Bowden & Johansen (2008) was divided over 3 articles. Important extraction elements are obtained from CRD (2009, p. 30), which mentions record number, author, journal, country of origin, year, and type of publication. Other specific study characteristics are essential as well, e.g. research goal and significant findings. The table contains the success factors or

barriers as mentioned in the corresponding papers. The extensive overview is preceded by the complete legend of these categories (Appendix A, Table 12).

Critical success factors, barriers, benefits, ...?

During the early stages of our research, we preferred to use the term CSF rather than barrier or similar names. However, most sources appear to refer to barriers rather than CSFs. Besides, terms such as 'problems', 'key aspects', 'drivers', 'enablers', 'benefits', 'concerns', 'key factors' and 'critical issues' are also widely used in the articles to declare the difficulties and advantages of an IT system as perceived by primary care practitioners. The difference in terminology can be explained by the fact that the term CSF is commonly used in relation to business analysis, e.g. from a business officer's perspective. On the other hand, primary care practitioners rather refer to their experiences and efforts with IT systems. For this reason, all observed key findings they mention with regard to the pros and cons of an IT innovation in daily practice have been included and in most cases they are literally derived.

Notably, the contents of both the innovation purpose and CSF columns are brief summaries of the articles and in case of literal quotes, they have been cited in italics.

Comparison with other meta-analyses

Before classifying the CSFs into a manageable amount, we first examined the 3 SLRs obtained during the content extraction. Learning how other studies with the same scope determined the CSFs from literature is obviously a useful instrument and helps to avoiding reinventing the wheel. Castillo, Martinez and Pulido (2010) conducted a research on success factors for EMR adoption by physicians. They defined 6 main CSF categories, including (1) user attitude towards information systems, (2) workflow impact, (3) interoperability, (4) technical support, (5) communication among users and (6) expert support. Another SLR-based study by Fontaine, Zink and Schilling (2010) elaborated on the success factors of health information exchange in primary care describes (1) cost savings, (2) workflow efficiency and (3) quality. The third interview on the purposes of doctors for using the internet (Masters, 2008) defines (1) time, (2) workload and (3) cost as discouraging factors, while (4) patient satisfaction, (5) belief in improved service delivery, (6) time savings and (7) demand from patients are encouraging factors.

Based on these existing studies, we embraced and combined similar categories in order to have a good starting point. For instance, the CSF category '*financial impact*' was created as a joint of cost savings (Fontaine et al., 2010) and cost (Masters, 2006). Merging expert support and technical support into one 'support' related factor is another example. Third, our CSF '*workflow & efficiency impact*' is largely based on workflow impact (Castillo et al., 2010) and workflow efficiency (Fontaine et al., 2010). As a result, we set off with '*workflow & efficiency impact*', '*attitude towards IT*', '*knowledge, skill & support*', '*financial impact*', '*care quality*', '*interoperability*', '*user satisfaction*', '*time concern*' and '*communication impact*'.

Hence, while we used the SLR studies as a basis for our taxonomy procedure, they did not completely cover our comprehensive database, which made a partially manual classification inevitable. Apart from that, these SLRs were all focused on small parts of the research area we attempt to cover, as they are all about specific innovations (e.g. EMRs) or focus areas (e.g. internet and information

exchange). Our research is distinctive in terms of scope, i.e. our purpose is to provide a general view on success of IT innovations in general practice, regardless of the innovation type.

Classification: from 212 to 23 CSFs

While classifying the CSFs, we used both a bottom-up and top-down method. First the findings from the article were attempted to side with a category obtained from the meta-analyses in the previous step (i.e. top-down). If this was impossible, we literally labeled the success factor or barrier as a unique entity. Second, if they showed equalities with an existing CSF, they were counted as such (bottom-up). For example, the articles by Keddie & Jones (2005) and Mechanic (2008) both refer to lack of support in their original paper, while the first emphasizes skills and the second denotes training. As these findings are closely related, they were classified as one general success factor. We applied similar aggregations to other related findings, such as efficiency and productivity related outcomes. These joints proved to be very useful by accident, because many sources mentioned some issues in one breath. For instance, Archer & Cocosila (2006) refer to “*legal and privacy issues*” as one barrier. *Workflow, efficiency & productivity impact* is a similar example of close related factors merged into one. Because articles like Mannan et al. (2006) mention “*workload and work pattern concerns*” as a single problem, it makes the choice for combined success factors more obvious.

Hence, these classifications are both theoretically and manually achieved. This is also the case for innovation types and research scope. Table 4 shows three examples of the data extraction process. This way of classifying conforms to research by Chaudhry et al. (2006), who conducted a systematic review on quantitative studies concerning health IT. The authors labeled the IT services manually as well and used a similar design.

#	Innovation type	Research area/ scope	Country	Innovation & research purpose	CSF category	Critical success factors/ barriers
4	EMR	PC	CA	To improve the adoption of an EMR system in Canada.	1, 4, 10, 12	Critical issues to adoption: (1) facilitating conditions (financial risk), (2) social influence (psychological risk), (3) performance and effort expectancy (performance risk), (4) legal and privacy issues.
Archer, N. & Cocosila, M. (2006). Improving EMR System Adoption in Canadian Medical Practice: A Research Model. <i>Proceedings of the 2009 World Congress on Privacy, Security, Trust and the Management of e-Business</i> , 121-132.						
22	NS	GP	UK	“To determine the prevalence of use of a range of ICT applications in general practice in London, UK.”	2, 3, 4, 15	Implementation barriers concern (1) time to implement, (2) lack of technical support, (3) finance, (4) lack of training, and (5) attitude of colleagues towards an ICT innovation.
Keddie, Z. & Jones, R. (2005). Information Communications Technology in General Practice: Cross-sectional Survey in London. <i>Informatics in Primary care</i> , 13(2), 113-123.						
33	EMR	PC	US	Researching the way in which IT and EMRs can improve medical professionalism and quality of care.	3, 4	Mentioned barriers in the paper include (1) initial financial risk and (2) lack of IT skills/support.
Mechanic, D. (2008). Rethinking Medical Professionalism: The Role of Information Technology and Practice Innovations. <i>Milbank Quarterly</i> , 86(2), 327-358.						

Table 4 – Three examples taken from Table 13. Full legend and table can be found in Appendix A.

Innovation type EMR = Electronic Medical Record; NS = Not Specified

Research area/scope	PC = Primary Care (semi-specific); GP = General Practice (specific)
Country	US = United States; CA = Canada; UK = United Kingdom
CSF category	1 = Workflow, productivity & efficiency impact; 2 = Attitude towards IT; 3 = Knowledge, skill & support barrier; 4 = Financial impact; 10 = Legal, security & privacy concern; 12 = Technological impact & control; 15 = Time concern

Table 5 – Reduced legend with only the relevant abbreviations and CSFs included from

Analysis of results

Both general and particular information can be obtained from the extracted data. First, we provide some background information from the articles that made it to the final selection in order to get insight into the different source characteristics, e.g. country, year and research area. Then, we elaborate on the identification of the CSFs and their distribution over the different innovation types.

Background results

The 58 sources were reduced to 56, because the study by Protti et al. (2008) concerns one study divided over several papers. Not surprisingly, up to 50 percent of the studies originate in the United States, (Figure 11). The United Kingdom either plays an important role (19 percent), while Australia (7 percent) and Canada (5 percent) amount a notable portion as well. Some studies cover a large number of countries as they concern a country comparative research (5 percent). Notably, The Netherlands was only mentioned once (2 percent).

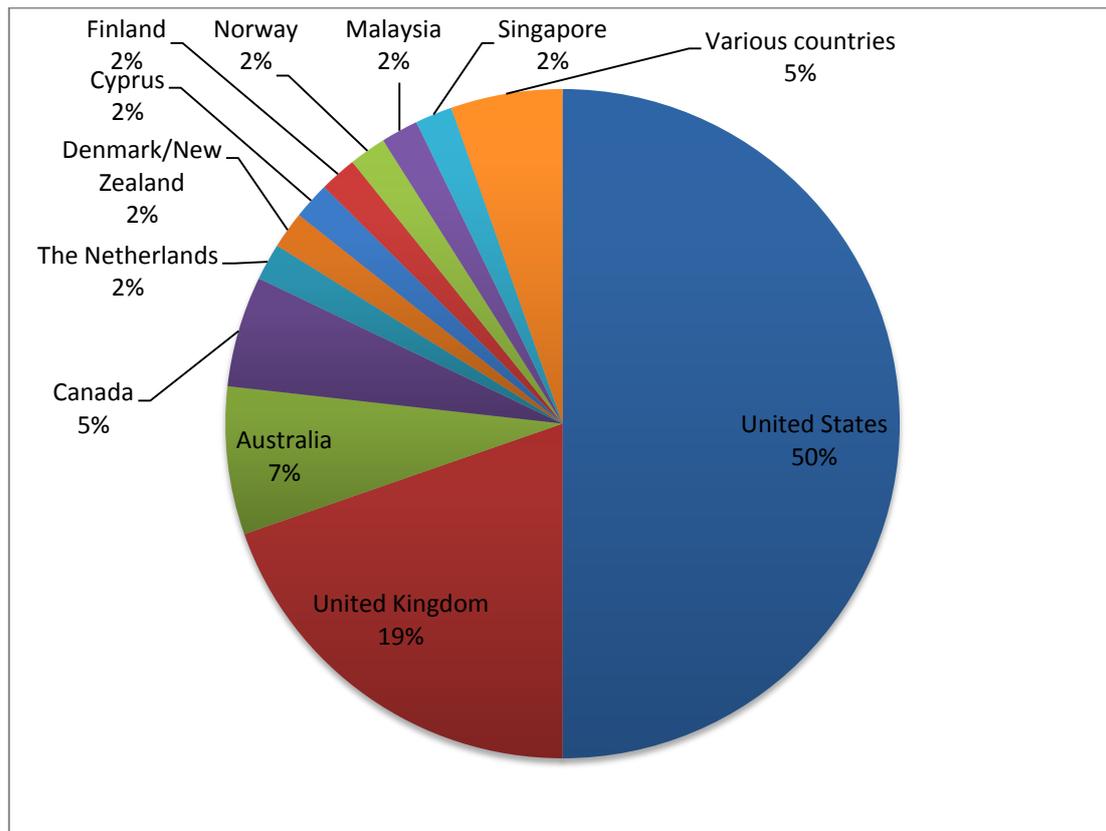


Figure 11 – Distribution of countries.

About 66 percent of the sources were published during the previous 5 years, i.e. 37 out of 56. Hence, most selected studies are quite recent and though primary care and IT have been discussed for years,

there is only one source from the late 1980s. Obviously, science is increasingly drawing attention to this subject (Figure 12).

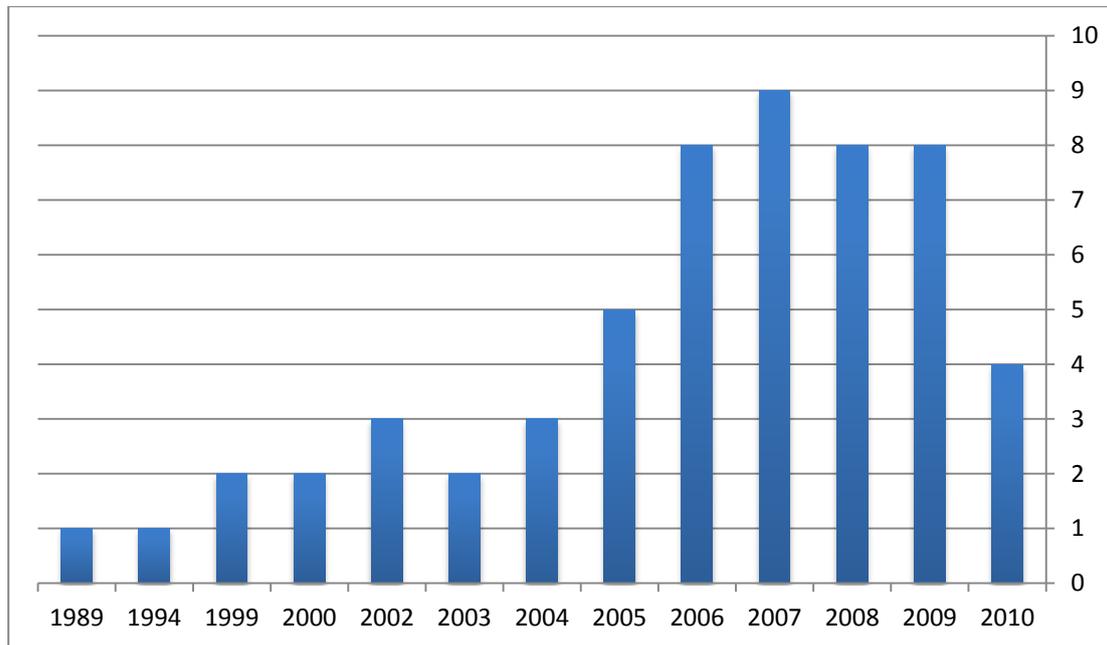


Figure 12 – Number of articles per year.

Another remarkable characteristic is the partition of activity fields. While 17 sources (30 percent) specifically mention general practice, the other 39 ones (70 percent) only mention primary care as research area. Hence, 39 percent has a wider scope than desired,

Surprisingly, the articles that made it to the final selection are nearly all scientific. Peer-reviewed journal articles form a major group (87 percent), while the database contains 4 conference proceedings (7 percent) and 1 working paper as well (2 percent). Only one book and one book chapter are labeled as grey literature (4 percent). Grey sources regularly lack in verifiable and grounded article titles and content, which made it difficult to pass through the early filter procedure.

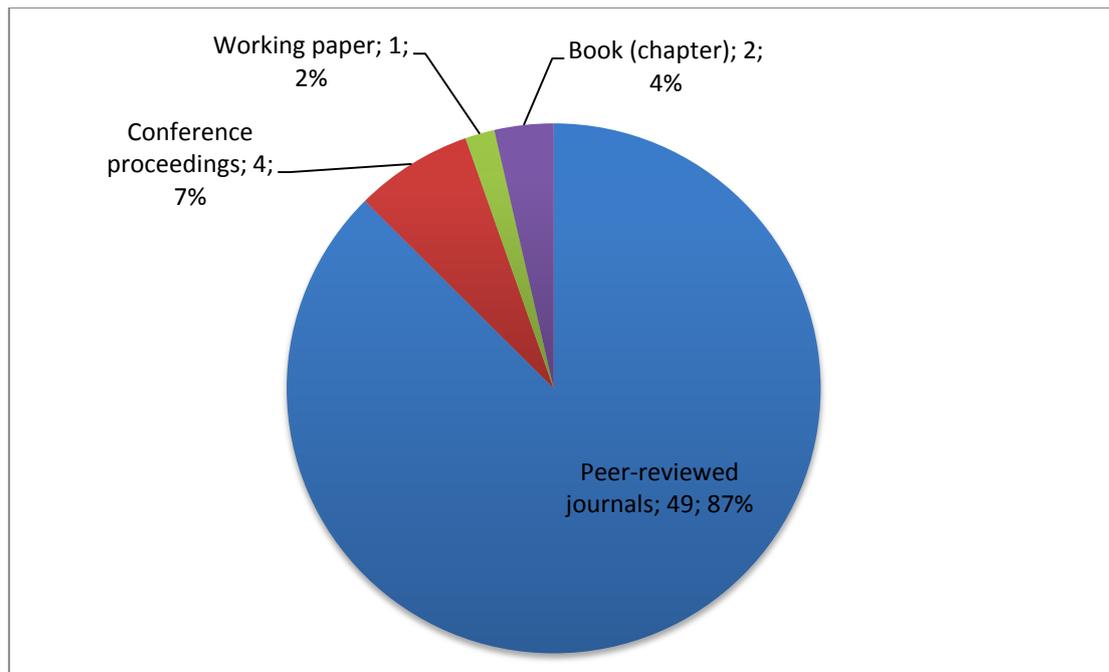


Figure 13 - Source types

Furthermore, the types of innovation that the sources refer to are mostly EMRs (20), virtual consultations (10), electronic prescribing (6) and clinical decision support systems (4). A relatively large number of papers does not mention a specific innovation, as they point out IT products and services in general, e.g. Lovell and Cellar (1999) with their paper *Information Technology in Primary Health-Care* and Bodenheimer and Grumbach (2008) who wrote the book *Improving Primary Care: Strategies and Tools for a Better Practice*. Note that the total sum of innovations (59) is larger than the number of sources (56), because some papers involve more than one innovation (Figure 14).

Though the high amount of articles on EMRs is not surprising, it is important to realize that EMRs all over the world can be widely interpreted. In some cases, it only concerns some basic patient data such as allergies, blood groups and heredities. On the other hand, EMRs can also refer to an extensive documentation of personal health episodes.

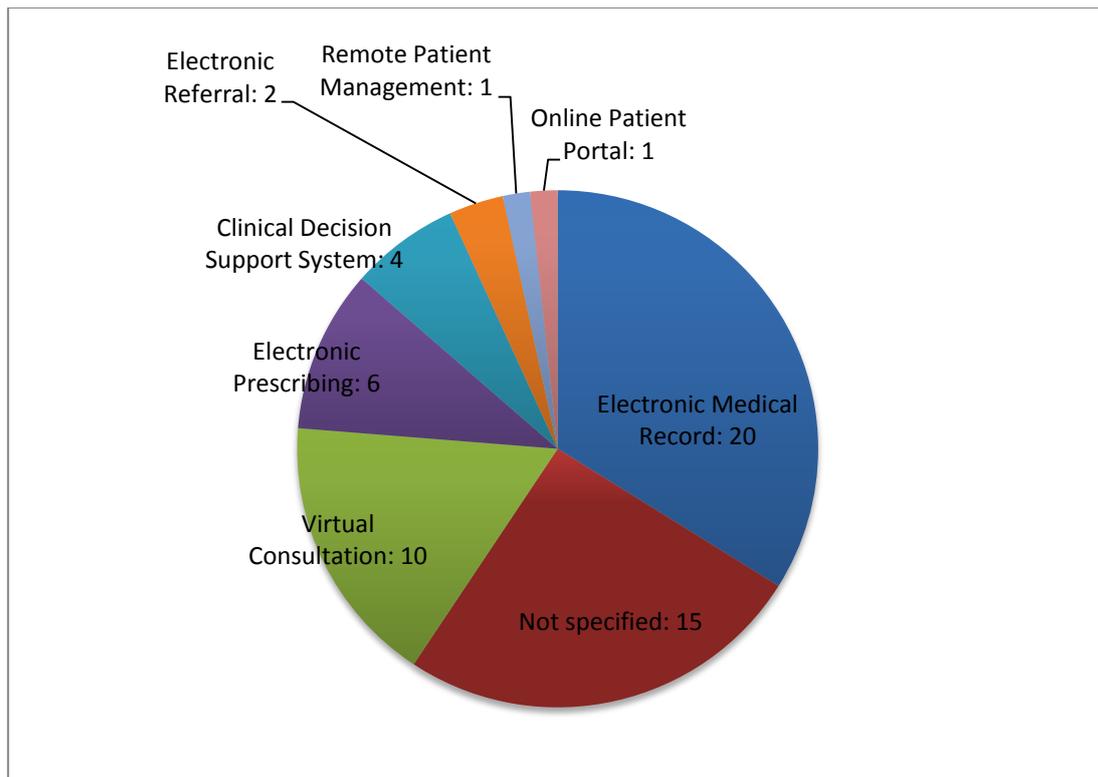


Figure 14 – Innovation types remarked in the articles.

In addition, the type of journal where the article was posted provides some good insight (Figure 15). Based on the title of the journal, the research area was being extracted in order to know where the sources actually originate. The research areas from Figure 7 were used as category, i.e. health care, IT and economics. For instance, the journal *Health Affairs* is part of the group Health Care, because the journals' main subject of interest are general health care issues. Another example is *Health Policy*, which is both about health care and the management of rational outcomes. Hence, the group of health care + economics/management applies to this journal. A third example is the journal *Proceedings of the 2009 World Congress on Privacy, Security, Trust and the Management of e-Business*, where the main subject e-business relates to both IT and economics/management. Fourthly, *Methods of Information in Medicine* publishes "papers in the whole range of processing data, information and knowledge in medicine and health care, including research in traditional as well as in new areas of this expanding field" (Schattauer, 2011). Similar trade-offs were done for all other journals, through which we were able to determine their field of interest and scope.

The results are clear: journals on health care (33 percent) and both health care and IT (44 percent) are by far most representative. From the 3 research areas, health care is for 85 percent at least part of a journal subject. A respectable 60 percent of the journals have full or some affinity with IT. Remarkably, only a small number of sources (12 percent) have a link with the field of economics and management. It indicates that most of the articles are written from a health care or IT perspective.

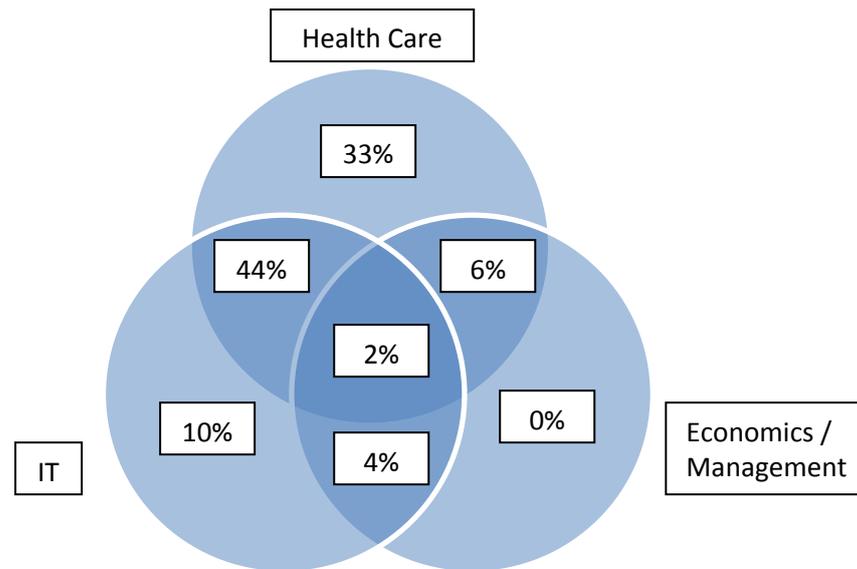


Figure 15 – Coverage of the journals over the 3 research areas.

CSF results

Now the backgrounds and origins of the sources have been abstracted, the success factors and barriers can be introduced. As mentioned before, all the classified success factors from literature have been determined, but more importantly, they have been categorized as well. We already elaborated on the achievement of this CSF selection previously (p. 37, Classification: from 212 to 23 CSFs).

Next to elementary reasons, there is also a practical point: the factors are better classifiable and countable when assigned to fewer categories .

#	CSF or barrier	Description
1	Workflow, productivity & efficiency impact	Every aspect that influences the daily workflow i.e. time saving or time-consuming activities caused by the implementation or use of an innovation.
2	Attitude towards IT	Bias of involved people (i.e. patient or doctor) with regard to implementing an IT solution.
3	Knowledge, skill & support barrier	Concerns about the lack of (technical) support or in-house knowledge to use an IT innovation in practice.
4	Financial impact	High investment costs and uncertainty about the return on investment.
5	Quality concern	The influence of the IT innovation on the quality of care. It is reported either as an improvement [success] or deterioration [barrier] in quality.
6	Interoperability	The extent to which information between systems is or can be exchanged.
7	Guidelines & standardization	Concerns about the guidelines, standards and other regulation aspects that comes along with innovation.
8	Competition impact	The competitive advantage that can be gained by the implementation of a new innovation.
9	Communication impact	The positive or negative influence of changes in communication.
10	Legal, security & privacy concern	Factor about any kind of legal, security and privacy issues, caused by concerns and resulted by implementing new IT.

11	Social & cultural impact	Influence on doctor-patient relationship as well as social economic factors.
12	Technological impact & control	Difficulties in learning and choosing new technologies, as well as fear to lose control due to technology intervention.
13	Vendor & provider issues	Concerns about vendor selection and maintaining the provider relationship.
14	Political support	The extent to which IT innovations are supported by governmental and local authorities.
15	Time concern	Lack of implementation time [barrier], but also the time savings gained by the innovation [success].
16	System reliability	Concerns about the reliability and dependability of IT systems.
17	User satisfaction	The extent to which the innovation satisfies the user while using the system.
18	Perceived forecasted value	Perceived usefulness of the innovation for future use.
19	Ease of use	User-friendliness and accessibility issues of the IT product/service.
20	Incentives concern	Lack of motivation, i.e. "why change if everything works fine?"
21	Presence of IT manager	The presence of an IT manager to direct and lead the employees (i.e. primary care practitioners) .
22	Physician involvement in development and/or implementation	The extent to which the primary care practitioner participates in the development process of the IT innovation.
23	Patient access and/or traveling impact	The improvement of access and distance decrease as result of IT utilization, which is especially relevant in case of virtual consultation if the patient is a bad walker or must travel a great distance for primary care.

Table 6 – Explanation of the critical success factors.

From the 58 sources, a total of 212 success factors and barriers were extracted, divided over 23 categories (Figure 16). It is interesting to see that a few factors are trendsetter, including *Workflow, productivity & efficiency impact* (32 measures), *Knowledge, skills & support barrier* (28), *Financial impact* (25), *Quality concern* (17), *Attitude towards IT* (16) and *Legal, security & privacy concerns* (13). Other notable factors are *Guidelines & standardization*, *Interoperability*, *Technological impact & control*, and *Time concern*. Several properties can be derived from these success factors. First, they are specific for a phase of the innovating process. For example, whereas *Workflow, productivity & efficiency impact* and *Ease of use* apply to the operational stage of an innovation, *Financial impact* and *Attitude towards IT* are rather acceptance issues and, thus, important at a preliminary phase.

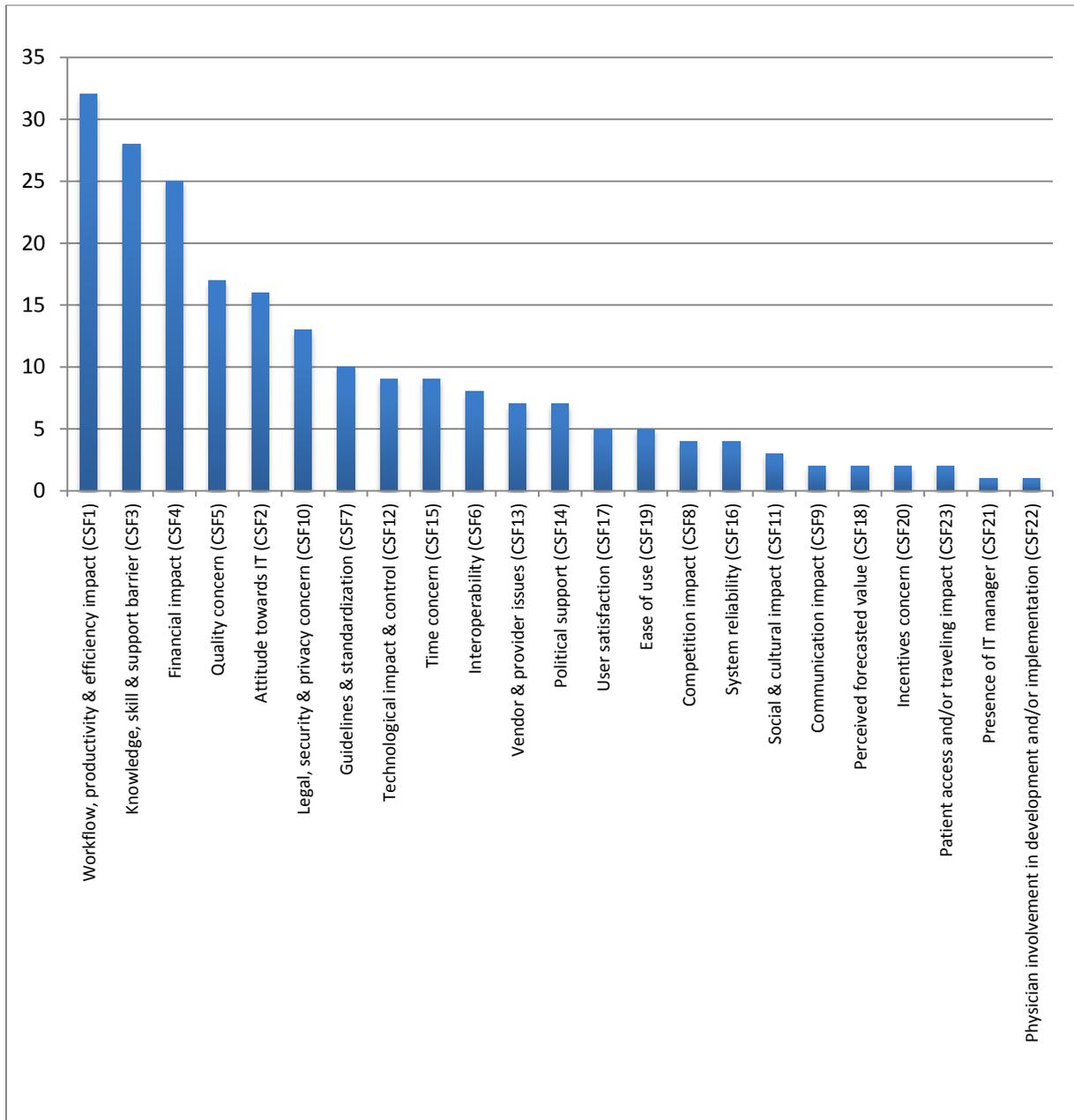


Figure 16 – Frequencies of measured CSFs.

Merging innovation types

Next to the separation of innovation phases, it is also interesting to consider the success factors that relate to different innovation types. These types were presented in Figure 14. Each success factor could more or less be applicable to specific types of innovation. For instance, privacy issues are probably less relevant for CDSSs than for EMRs and VCs. Due to the nature of innovation types ER and EP, which are usually ingredients of EMRs, they were joined into the EMR label. Besides, VC has been given a broader scope (i.e. Virtual Communication instead of Virtual Consultation), hence the OPP type is now hosted by innovation type VC. As a result, we have 4 main innovation categories left. Figure 17 shows how many times each innovation type mentions the success factors, mentioning both the absolute amounts of CSFs inside the bars and the percentages on the vertical axis.

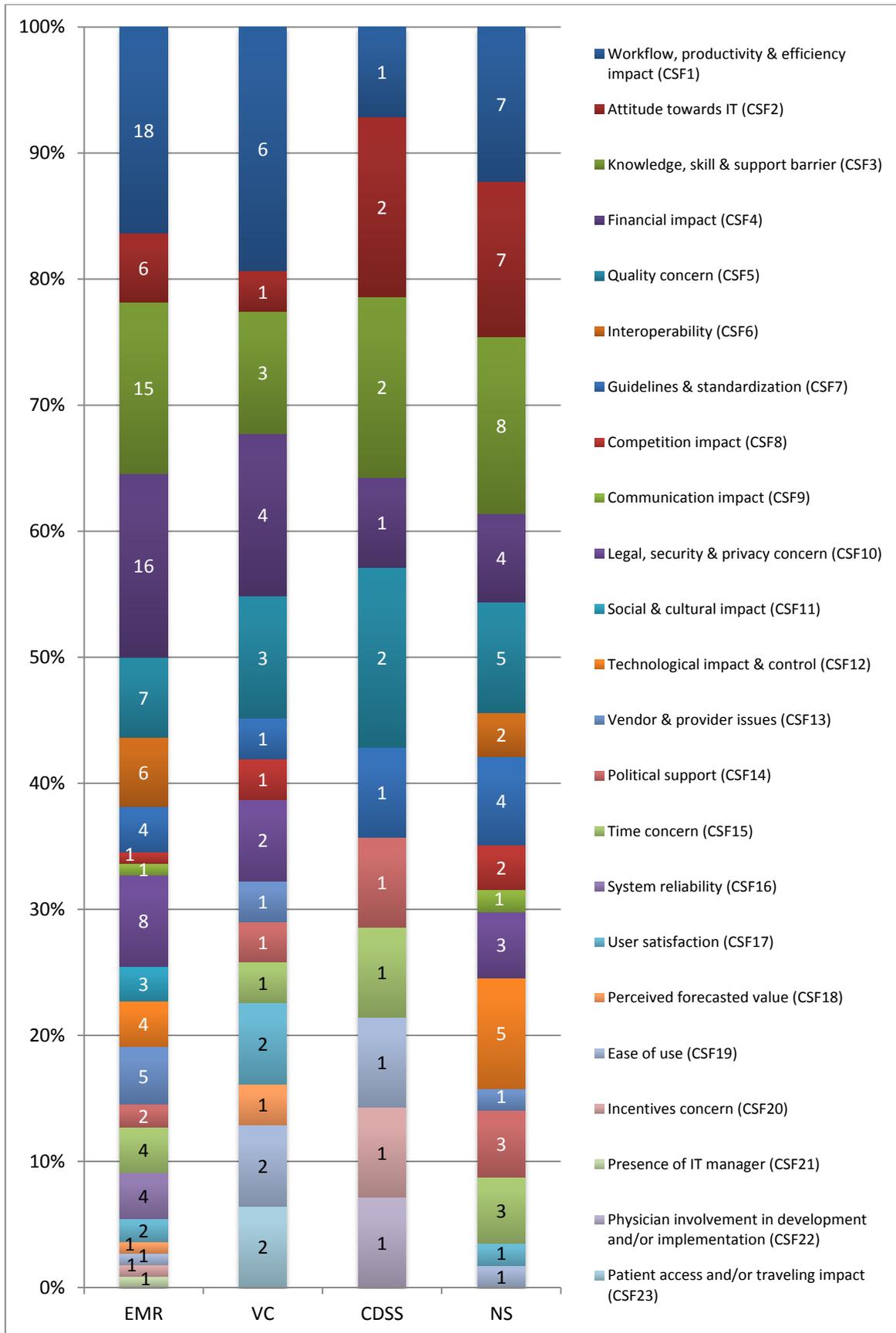


Figure 17 – Distribution of the CSFs over the 4 innovation types including the not specified innovations (NS), which is about general IT innovations in general. Descriptions of the CFS numbers and abbreviations can be found in Table 12.

Some notable findings can be derived from the figure. First, there are some obvious differences between the CSFs that are mentioned for specific innovation types, which can be obtained through the percentages. For instance, technical support appears to be more important for CDSSs (14,3 percent) than for VC (9,7 percent). On the other hand, financial impact is rather a barrier for EMRs (14,3 percent) and VC (12,9 percent) than for CDSSs (7,1 percent). Another example is the attitude towards IT, which is a significant factor for CDSSs (14,3 percent), but is only a minor issue for VC (3,2 percent). EMRs and VC related articles refer more to workflow issues than CDSS.

Second, the NS category, which represents the global studies on IT innovations in primary care without referring to a specific innovation type, shows some moderate results as one could expect. The factors that were mostly mentioned give average scores for NS. Its values are in most cases between the values of the three innovation types, at least for CSF1, CSF2, CSF3, CSF4, CSF5, CSF7 and CSF10. This indicates that sources that do not concern a specific innovation certainly provide some reliable and useful information about IT innovations in general.

Furthermore, a relatively large number of CSFs is only mentioned once or twice for each innovation type. On the one hand it can be explained by a low number of results, but on the other hand it could be occasional and infrequent as well. Obviously, differences exist between the importance of the success factors.

Although it is interesting to highlight the differences between success factors and barriers for each innovation type, it is not part of our research objective as we investigate IT innovations in general. Summarized, even though differences can be obtained, the figure shows on the whole agreements as well.

CSF distribution over countries

Next to the allocation of CSFs over innovation types, it is also interesting to look at other distributions. Table 15 showed that most articles origin in the US, while the UK represented a notable portion as well. Exploring the differences that primary care encounters in these geographical areas leads to some remarkable findings (Figure 18). As the rest of the papers are geographically fragmented and amount a small portion, they have been merged into one large group. Notable differences in CSFs measures can be read between the three groups. First, the attitude towards IT and skill & support issues play a more important role in the UK than in the US and other countries. Besides, concerns about political support have been reported relatively most in the UK, while the US does not have any included papers about political issues. This can probably be explained by the more liberal approach of the US regarding their health care system with less regulation than in West-Europe, until recently. Thirdly, papers from research in the US refer more to workflow, productivity & efficiency barriers than the UK and other countries. Furthermore, finance and quality concerns show similar results between the three countries, as well as interoperability and legal & privacy issues. In contrast, concerns about guidelines and standardization are more subject of discussion in US studies than UK and other countries.

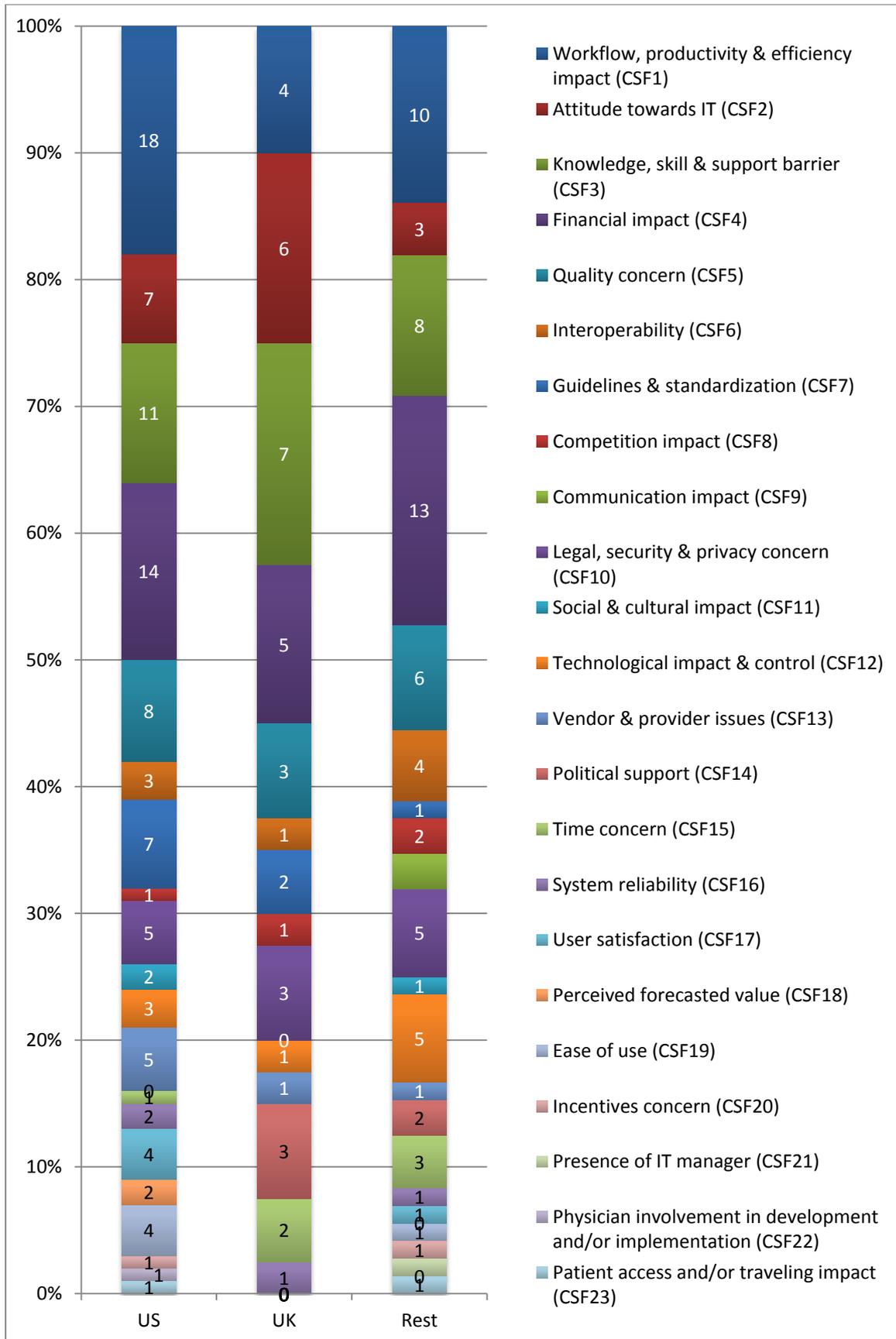


Figure 18 – Division of the CSFs over the US, UK and the other countries.

CSF distribution over distinctive time periods

Considering the development of approaches towards success of IT innovations in primary care between different time periods is a good way to find out which barriers were important two decades ago and which are important now. Figure 12 showed the division of the articles over the years, which helps us distinguishing three time periods, i.e. episodes of the research area:

- 1989-2003: the 'early years' of research into the field of IT innovations in primary care, when research was still scarce
- 2004-2007: the 'rising years' when interest in the research subject is on the increase
- 2008-2010: the 'arrived era', when the research has been stabilized

Having these periods are distinguished, we are able to observe the behavior of the frequencies of CSFs over time. The next two figures contain trends of CSF frequencies as a percentage of each time frame. The top-6 CSFs that have increasingly been identified through the years are shown in Figure 19. *Quality concern* (+5.9%), *competition impact* (+3.9%) and *social & cultural impact* (+2.6%) expose a steady growth through the years, while *financial impact* (+2.5%), *interoperability* (+5.6%) and *legal, security and privacy concern* (+5.3%) show a less predictable development, though they are still considerably more identified between 1989-2003 and 2008-2010. The figure only includes CSFs that have increased its share in the time frames between the early years and the arrived era with at least 2 percent.

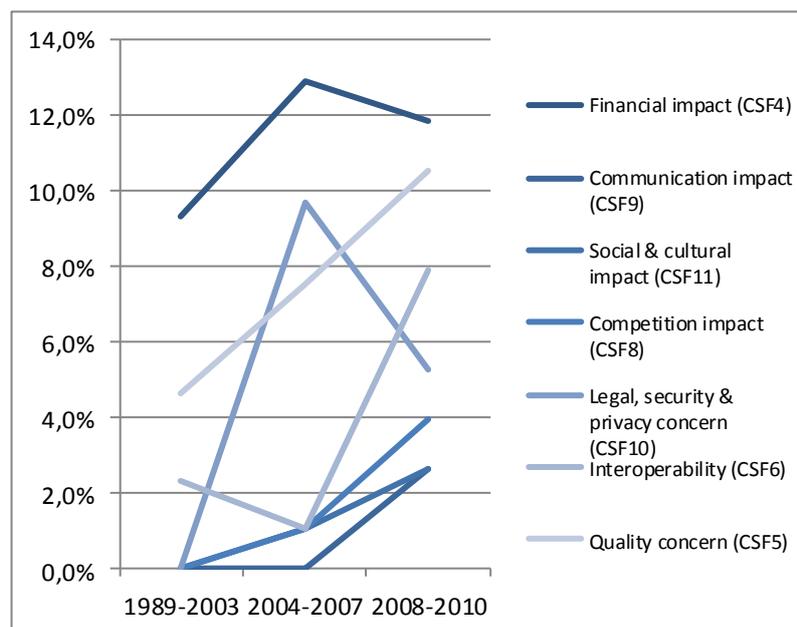


Figure 19 – Increasing CSF frequencies as measured from each time frame.

Conversely, Figure 20 consists of the CSFs that have become less subject of discussion through the years, at least deteriorating by 2 percent. These trends show more or less the same behavior: a steady decrease with *Knowledge, skill & support* as most notable outlier (-8.1%). Both *vendor & provider issues* and *political support* show a sharp fall as well (-5.7%).

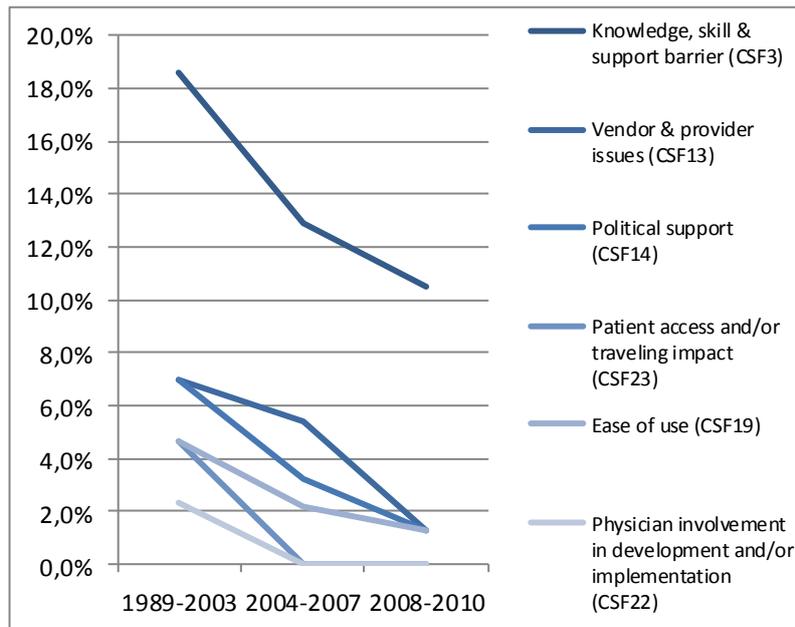


Figure 20 – Decreasing CSF frequencies as measured from each time frame.

Overall, based on the results from the SLR we were able to project the outcomes on many domains, i.e. countries, innovation types, time frames, etc. These different perspectives give us the possibility to conduct a valuable analysis on the data with the purpose of creating a framework for practice.

CHAPTER 3 – Modeling the critical success factors

In the previous chapter we elaborated on the execution of the systematic literature review and the outcomes. This chapter explains these results in relation to the theory and its practical value.

Two perspectives, two frameworks

While elaborating on a framework based on the SLR, the first important choice to make is the perspective to project on the framework. A good approach to take into account the input elements of the framework (i.e. the CSFs) and determine the best way to organize them.

Next to the derivation of the CSFs from literature, the SLR also provided insight into the different roles and stages an innovator copes with. For example, Kemper, Uren & Clarks (2006) elaborate on EMR adoption and Heimly (2009) reveals certain views on electronics referral systems. Both papers mention the factors that play a role during the preliminary stage of an innovation project in particular. Furthermore, Klein (2007) conducted a research on portal acceptance by both patients and physicians and refers to the relationship between these two actors.

Hence, based on the SLR outcomes, two frameworks are constructed viewed from perspectives:

- FRAMEWORK A: Stage-oriented, e.g. planning and implementation
- FRAMEWORK B: Actor-based (i.e. role-based), e.g. GP and patient

The next two sections elaborate on the construction of two frameworks, based on these two perspectives.

FRAMEWORK A: Stage-oriented classification

Our first intention is an attempt to apply the CSFs to different phases in time during an innovation project. While workflow and support related issues are relevant during the operational stage, political support and the presence of an IT manager are rather initial concerns. Also, some factors affect more innovation stages, e.g. interoperability, which is important during the design, implementation and use stage. These aspects can be used as ingredients for the framework.

Moreover, the inspected articles from the systematic review show a variety of measures between the CSFs, e.g. financial impact (25 measures) versus incentives concern (2 measures). It indicates that there is an importance factor, i.e some CSFs are probably more important or in more situations relevant than others.

Stages of innovation

The results from the systematic review imply that innovating in IT products or services is associated with a number of problems that arise during different innovation phases. We used the well-known Systems Development Life Cycle [SDLC] (Alexander, 2004; Vadher, 2010) as a base for these phases, consisting of planning, analysis, design, implementation and maintenance. This original SDLC is extended with the phase 'use', because practitioners are not only maintaining their innovation, but they deploy it as well. Besides, the iterative lifecycle Figure 21 contains overlapping areas, consisting of the grouped SDLC phases *planning/analysis*, *design/implementation* and *use/maintenance*.

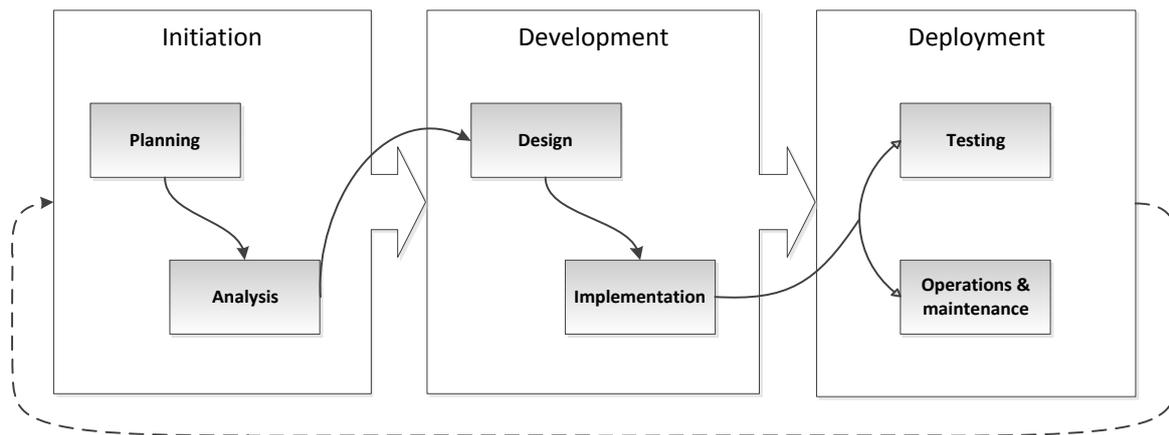


Figure 21 – The SDLC, derived from Vadher (2010) and adjusted to the situation of IT innovations in primary care. Note that the dotted arrow does not apply to shorter innovation projects that do not involve an iterative and ongoing alteration process.

Based on the visual representation and our SLR outcomes (Figure 16 and Figure 21) we are able to construct a general roadmap that can serve as a framework for both innovators and researchers. Innovators can use it as a set of brief descriptions (i.e. guidelines) that is recommended to be followed when they lead IT innovation projects in general practice. The descriptions can also be consulted by researchers as a framework, because unlike other Obviously, the wide scope of this research makes it difficult to go into detail on some points (e.g. financial calculations or measurement of care quality), because innovating in IT varies a lot in project size and practice size (large versus small practices). However, determining at which stage specific factors need certain attention is useful and therefore, practices considering a new IT innovation could benefit from this universal roadmap.

Practical value

Due to the wide variety of innovations primary care is rich in, it is impossible to provide step-by-step guidelines that apply to each IT innovation in primary care. The three tables are neither a measurement tool nor a detailed checklist that covers every possible situation. In fact, the framework gives general direction to innovators on different aspects during every innovation stage, which they have to interpret and adjust for their particular situation.

Note that not every IT innovation goes necessarily through all of the stages, thus some of them could be irrelevant in those situations. For instance, an online tool to make an appointment with the GP with a web browser, does usually not require the presence of an IT manager. Another example is outsourcing of the system to be implemented, in that case the design & implementation stage can be skipped as the IT innovators are not responsibly involved.

Descriptions and recommendations

The descriptions are all derived from the SLR findings. Although some of them are obvious, self-explanatory or very widely interpretable to cover in a short description (e.g. finance and workflow), others benefit from a succinct description and/or recommendation (e.g. sociability & culture). Two examples illustrate the establishment of the framework. First, 'Legislation, security and privacy' embodies a broad spectrum of evident legal and privacy related issues. Hence, no attention is drawn

to a definition of legislation, privacy and security, but a recommendation is given about a particular aspect in order to give innovators any direction. In this case the security layer to deploy on a user account system (e.g. DiGiD). Second, 'Incentives' is a complicated and ambiguous notion, for which a concrete aspect is not easily described. We focused on explaining why it is important to motivate and convince GPs to invest in newer and better systems, because some GPs tend to think that changing a good working system is pointless.

Interpreting and using the framework

As mentioned before, creating a framework that covers any type of IT innovation in general practice is hardly feasible. In order to still meet the requirements, the final model has become quite universal, and therefore somehow not very specific. For innovators in primary care, it is important to take relevant aspects from the model and use them as they fit the innovation in the most sufficient way. Hence, it is not required to check if all factors and barriers are met for any innovation, though large projects will use a lot of them. The visual framework assists in determining which factors need probably most attention due to a higher importance factor, while the stages of innovation help to provide overview in when an innovator must focus on the factors that are relevant at that specific moment.

Planning & Analysis	Design & Implementation	Use & Maintenance
Finance	Guidelines & standardization	Workflow, productivity & efficiency
Legislation, security & privacy	System reliability	Care quality
Attitude towards IT	Ease of use	Knowledge, skill & support
Political support	User involvement	Technology & control
Sociability & culture		Interoperability
Incentives		Communication
Presence of IT manager		Patient access & traveling
Perceived forecasted value		User satisfaction
Available implementation time		
Competition		

Table 7 – Synopsis of FRAMEWORK A. The complete framework including implications for practice is listed in Appendix B.

Also, in case of larger innovation projects it is recommended to create an own customized framework based on this general one, at which practical implications of each relevant factor is filled in, brainstormed and assessed. For instance, an advanced video consult system comes at the point of the first usage by the GP, when documentation, training and support becomes important. An own checklist must be made about which practical, procedural and theoretical facts the GP must learn and at what points he needs one or more training sessions. Especially in case of a larger health center

where more GPs are involved, the checklist becomes decisive in ensuring that every GP acquires all the required knowledge.

Table 7 contains a stripped version of the framework. It embodies the CSFs divided over the stages of innovation, but without the descriptions. Horizontally, the stages from beginning to end are visualized, while the factor importance is projected vertically. The full version of the framework, including the associated descriptions, can be found in Appendix B.

FRAMEWORK B: Actor-based CSF flows

Our second endeavor to visualize the CSFs is to model them from an actor-based perspective.

Project management

In many situations, IT innovations for general practice are realized during projects, where project management [PM] is a key aspect. A central aspect of PM is to divide the work and responsibilities over the workers. This aspect is covered by the well-known PRINCE2-method within its 7 principles, i.e. “pre-defined roles and responsibilities”. A project only succeeds if the appropriate individuals are being involved and if every person knows his responsibilities (Prince Official Site, 2012). Therefore, it is interesting to construct a framework covering the different roles of an IT innovation in general practice and to project the CSFs on it in relation to these roles.

Actor based (role based) model

Considering IT innovations from different user perspectives (e.g. GPs and patients) helps us to provide insight into the dependencies of the CSFs in relation to these roles. For instance, are some CSFs being involved by only one or two actors? In other words, to what extent can each actor make the innovation successful?

Figure 22 represents a visualization of the CSFs in relation to the different innovation roles. These roles were derived from the SLR, while extracting innovation project information from the collected papers:

- The innovator, usually the role of project manager or program manager.
- The GP, who acts as caregiver
- The patient, a recipient of care

Other actors could certainly be considered as well, but they are only actor in particular situations, e.g. hospitals and vendors. Therefore, the framework is limited to the most bare roles which will always apply.

The CSFs were positioned based on their relevance with regard to the actor(s). For example, user satisfaction and ease of use are factors that are experienced by the end-user of a system, i.e. the patient and/or GP.

Interpreting and using the framework

The IT innovation is the center of the framework, and is surrounded by the innovator, GP and patient. The GP is the most important actor, because he communicates with both the innovator and

patient. The SLR learned us that finance and workflow are concerns which only affects the GP. Hence, the other roles have no practical influence on these CSFs. Furthermore, security and care quality are shared topics between the GP and patient, where security also involves the IT innovation in terms of technical realization. According to the SLR findings, the attitude towards IT is mainly a barrier for GPs, though one could make a case for the patient's attitude as well. It is important to know that this is the only factor that slowly drops from the top of the CSF list, as identified in Table 7. At last, the guidelines with regard to the implementation and deployment of the innovation is the subject matter for both the innovator (technical guidelines) and GP (practice guidelines).

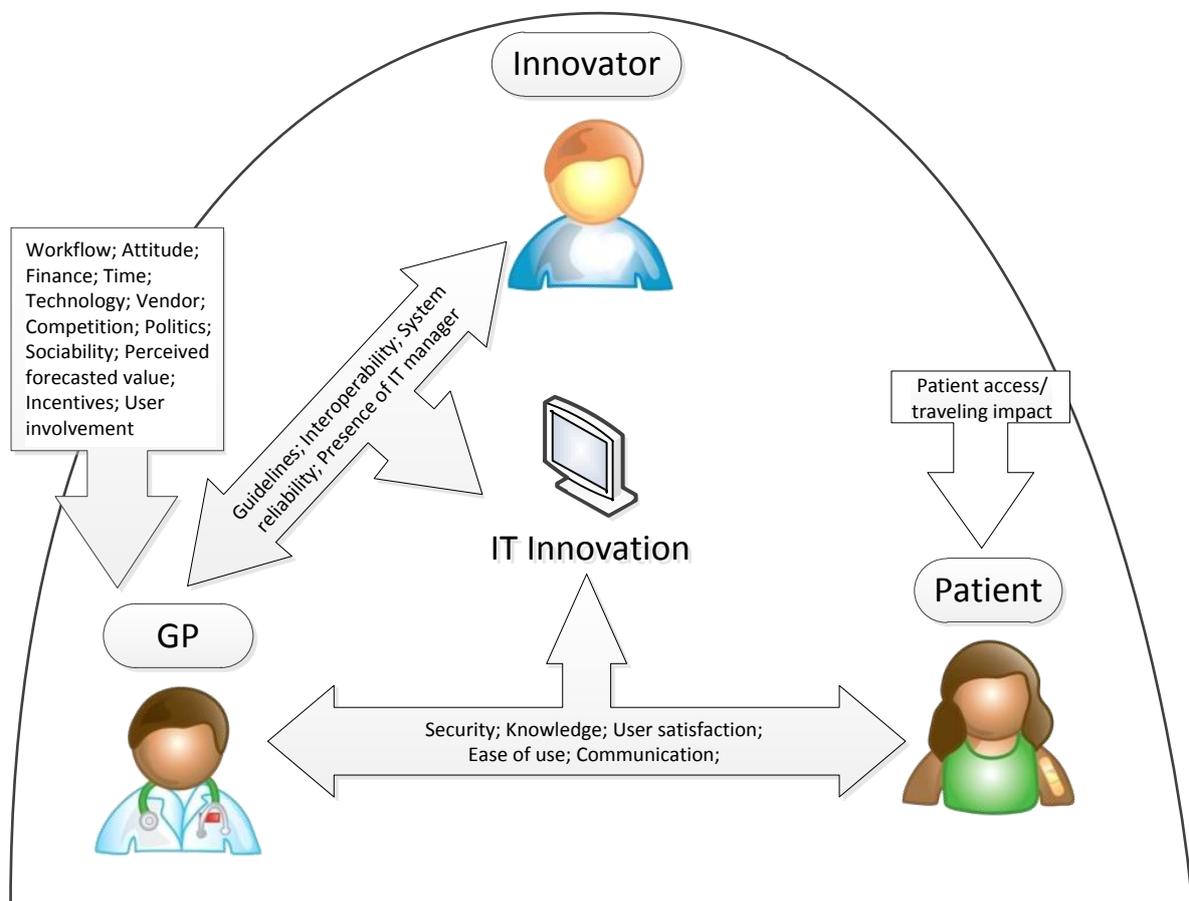


Figure 22 – FRAMEWORK B: the distribution of CSFs in relation to the three main actors in primary care IT innovations.

FRAMEWORK A & B comparison

FRAMEWORK B complements FRAMEWORK A in two ways. First, it provides insight into the involvement of different actors in relation to the CSFs. For example, regarding the most important factors the innovator has no direct relation with the patient. Second, compared to FRAMEWORK A it facilitates a quick view on the significant factors, which helps to identify the major problems at a glance. Hence,

while FRAMEWORK A functions as a content-driven guideline table, FRAMEWORK B is rather a visual representation of the whole.

Summary

Summarized, FRAMEWORK A and B are both theoretical constructs, based on the SLR findings. FRAMEWORK A emphasizes the guidelines per innovation stage, while FRAMEWORK B focuses on the involved actors. The next step is to learn to what extent these results are on the same wavelength as examples from practice, which is discussed in the next section.

CHAPTER 4A – Expert interviews

Former American baseball player Yogi Berra once said:

“In theory there is no difference between theory and practice. In practice, however, there is.”

The previous part showed some theoretical evidence of success factors in IT related primary care projects. However, it is uncertain to what extent professionals in the workplace experience the theoretical constructs into their daily practice. Many different people are involved during the process of innovating, and every individual faces other problems, depending on the role (i.e. general practitioner, project manager or patient), project (e.g. patient portal or video communication) and personality. Hence, having some people speaking from experience who give their perception about such projects helps to improve the frameworks as presented in the previous section.

Two interview rounds

Two rounds of interviews were conducted, with the purpose of improving the findings from theory twice in order to get more reliable results. In the first round, practice interviews were taken from field experts who possess a specific job in the innovation chain as illustrated in FRAMEWORK B (Figure 22). The second round differs from the first round in two ways:

- The experts have 30 or more years in health care and are considered as senior experts with a reliable view on health care in general.
- After the first round, adjustments to the frameworks were made in order to let the experts judge on a refined version of them.

Guidelines and rules for interviews

Before conducting the practice interviews, a number of guidelines were followed as mentioned by Baarda, de Goede and Teunissen (2001) in their instruction book about qualitative research.

Interview candidate selection

The first major object is to select suitable candidates to interview (p. 113-114), which we obtained by contacting relevant people from the fragmented field of IT innovations in Dutch primary care. We selected three health care or IT professionals, resulting in Amsterdam, Utrecht and Nijmegen. Besides, we interviewed a patient speaking from experience (Alphen a/d Rijn).

In order to get insight into the way professionals and patients think about success of IT innovations in primary care, we conducted 4 interviews with the purpose of covering each role from FRAMEWORK B (Figure 22).

Interview #	Actor (role)	Interviewee (anonymous)	IT Innovation	Location	URL
Session 1	Innovator	Expert 1, Expert 2	PAZIO	Utrecht	http://pazio.nl
Session 2	Innovator	Expert 3	Health Bridge	Nijmegen	http://www.healthbridge.nl
Session 3	GP	Expert 4	ZAHBA	Amsterdam	http://www.amc.nl/index.cfm

					?pid=2013
Session 4	Patient	Patient 1	VoeDietist	Alphen a/d Rijn	N.A.

Table 8 – Overview of the interviewees. Note that Expert 1 and Expert 2 were interviewed during the same session.

Table 8 shows the overview of the interview sessions. As the table shows, each session concerned at least one expert who has experience with a specific IT innovation where some of the questions focused on. Besides, other questions were about their general experience of IT innovations in primary care (Appendix C). Although they confirmed to have no problem with publication, we disidentified the original interviewee's names in order to secure privacy.

Interview design

While designing the interview, we determined to conduct a semi-structured interview (Baarda et al., 2003, p. 133-134), resulting in fixed subjects but flexible questions and answers. The interview contained three parts:

- During the beginning of the interview, we asked the experts to describe themselves and to tell something about their background in health care.
- The next part of the interview concerned the specific innovation case, focusing on both ways to monitor a project and, obviously, the factors which determine the success of their projects. Besides, additional questions about the different roles (i.e. actors) and stages during an innovation process were asked, for example *“What are the important actors(e.g. innovators, patients, GPs) during an IT innovation project in primary care? Which actor experiences the most difficulties?”*
- The last interview part contains the full list of 23 success factors as presented after the systematic literature review, and each interviewee was asked how relevant each factor was on a five point scale, from 1 (not important) to 5 (very important). We first wanted the experts to invent the success factors themselves (i.e. recall), whereupon they were asked to what extent the measured CSFs from literature they experience to be relevant (i.e. recognition). See Appendix C.

Interview execution

The interview execution took place at the interviewee's office in a real life face-to-face setting. As Baarda et al. (2001) mention, we attempted to make the interviewee feel confident in order to let him respond honest, natural and spontaneous (p. 116). It was important to take into account the limited time per interview (varying from 60 to 90 minutes). We used a smartphone to record the conversation and the printed interview questions to write down additional notes (p. 122). Afterwards we made an agreement on how to cope with private information, and we also provided a document with a summary of the interview to make sure that there was no doubt about particular quotes and ideas.

Interview analysis

The next step contained the analysis of the acquired information. First, a transcription was created with Express Scribe, a free software package in order to have all the relevant data on paper, discard irrelevant information and split the interview up in fragments (Baarda et al., 2001, p. 172-173). This procedure was followed by a repetitive labeling technique. We manually marked each useful

information entity containing useful information with synopsis terms in order to ease the analyzing process of finding equalities among fragments (p. 176-183). For example, quotes on a particular CSF were labeled as such, after which a collection of all quotes provided a clear view on the CSF. During this process we also combined the answers of the CSF into one large table for a comparison.

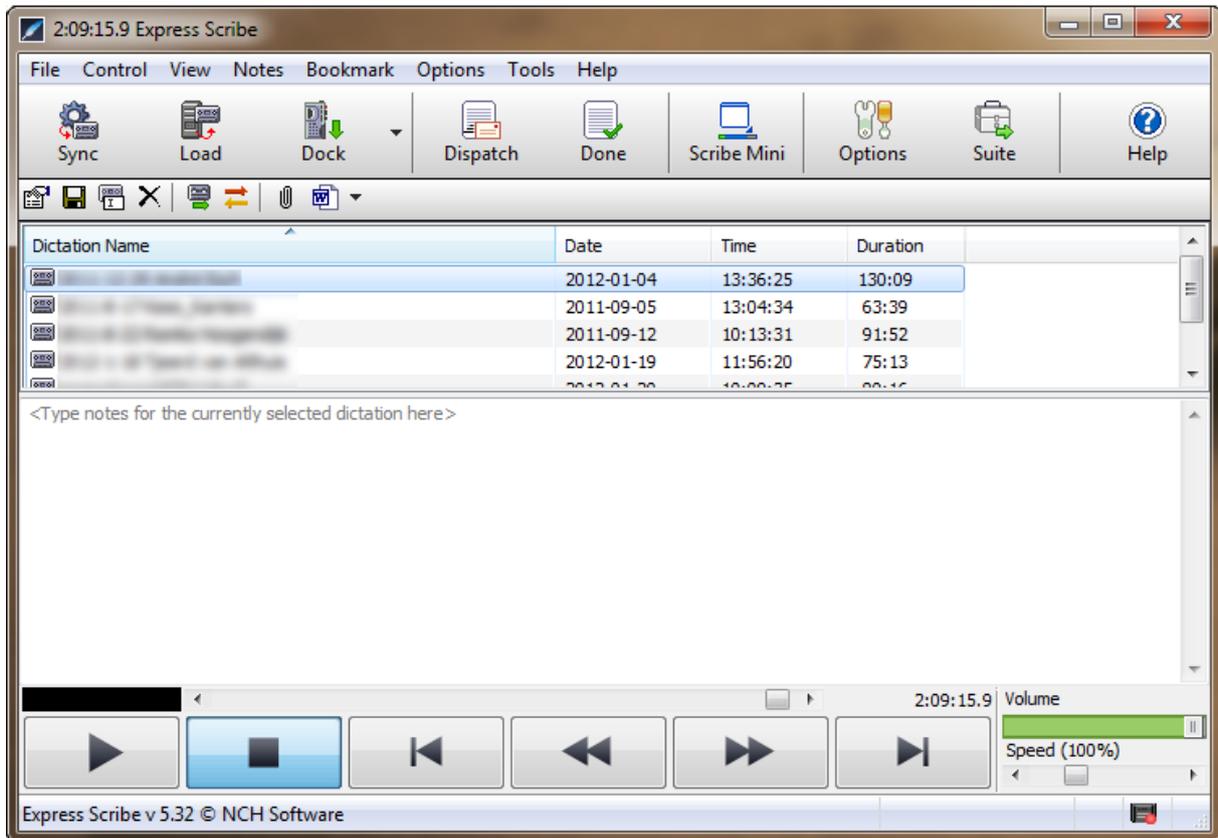


Figure 23 – Express Scribe, a software tool to ease the creation of interview transcripts manually. It supports speed adjustments, system-wide hot keys for pausing, rewinding and forwarding and additional options for the analysis of data.

Analyzing the labels manually and, subsequently, writing the chapters was the final part of the guidelines by Baarda et al. The next sections contain the interview sessions from PAZIO, Health Bridge, ZAHBA and The Voedietist.

Interview sessions

As previously mentioned, the experts were carefully chosen based on different innovation types and roles. For the analysis of the interviews, we made the following division:

- PART 1 – background information of the innovations, including innovation description and expert profiles:
 - INTERVIEW SESSION 1: PAZIO, an online portal
 - INTERVIEW SESSION 2: Health Bridge, a video communication system
 - INTERVIEW SESSION 3: ZAHBA
 - INTERVIEW SESSION 4: VoeDietist
- PART 2 – analysis of the interviews, with quotes from the participants:

- Section 1: Success factors and remarks
- Section 2: Expert views on CSFs from literature

INTERVIEW SESSION 1: PAZIO, an online portal

PAZIO is an online portal meant for both patients and caregivers, with the purpose of integrating existing e-health services into one platform. For the realization of this project, many parties were asked to invest or help with in this project: UMC Utrecht, Imtech, MediPortaal, VitalHealth, VitaValley, Gemeente Utrecht, Ministerie van Economische Zaken, NPCF, Provincie Utrecht and Universiteit Twente. Instead of creating 'just another portal', the PAZIO founders' idea was to look around what is already in the market and create an architecture that is able to enclose new and existing software into one service. The result was a dynamic and versatile platform which is still being developed.

Basic & additional apps

Each health center general or practice adopting PAZIO gets access to a set of basic apps, namely eAfspraak, eConsult, eHerhaalrecept, eConsult voorbereiding, eGeneriek zelfmanagement and Informatie. eAfspraak allows patients to make an appointment with the general practitioner online, while eConsult facilitates submitting a medical question to a doctor and receiving an answer. Repeat prescriptions can be gained through eHerhaalrecept and the other tools provide some additional self-management services. Figure 24 gives an impression of the portal's front page when a patient logs in.

The screenshot shows the main page of the PAZIO patient portal. At the top, there is a header with the logo for 'Leidsche Rijn JuliusGezondheidscentra' and the text 'Welkom, PazioTest PazioTest'. Below this is the title 'Mijn Zorgdossier' with a link for 'instellingen'. The main content area is titled 'Welkom op uw zorgdossier' and features several interactive buttons: 'Eerstvolgende afspraak' (with a calendar icon), 'Afspraken' (with a clock and calendar icon), 'Zorgplan' (with a book icon), 'Zelfcontrole' (with a heart and plus icon), 'Contact' (with a group of people icon), 'Zorghistorie' (with a clipboard icon), and 'Educatie' (with a book icon). A 'Weblinks' section is also visible on the left side.

Figure 24 – Main page of PAZIO, at which a patient is redirected after a DiGiD login. From this page the patient is able to choose between the several apps.

In addition to the basic apps, care providers have the possibility to let partners integrate their service into the PAZIO portal. Health centers and general practices can express their preferences regarding those services to PAZIO after which PAZIO decides whether or not to implement the service. While having a comprehensive variety of apps, a primary care practice is able to present a fully digital

environment for patients, which facilitates useful app intervention between every episode stage (prevention, diagnosis, treatment and aftercare).

PAZIO is a 'white label' product, i.e. the interface can be customized to a hospital's corporate identity or GPs house style.

Stakeholders in PAZIO

Figure 25 illustrates the conceptual framework of PAZIO. Notably, it contains obvious similarities with FRAMEWORK B (Figure 22), with respect to the actors situated around the innovation. An essential difference is the addition of the researcher as a stakeholder. One of PAZIO's cornerstones is to improve care by digitalizing, monitoring and analyzing all the data with the purpose of detecting and linking affections and diseases, and to improve the software as well.

The way PAZIO interprets the role of the innovator is also an interesting characteristic. Instead of stating that the innovator is one single acting party, they rather believe in stakeholders management: a group of regional stakeholders who fit the role between the care giver, researcher and innovation.

DigiD, a recognizable log-in system

Another noteworthy aspect is the addition of DigiD, a login system for Dutch citizens at government websites, e.g. tax authorities and municipalities. Implementing this system helps to inspire confidence by patients because they are already familiar with it, but it also allows health professionals to associate correct citizen data with their health information. Moreover, patients do not need to create separate account.

Expert profiles

The interview on PAZIO was conducted in one session with two experts.

Expert 1 (E1)

E1 is program manager at PAZIO. Ten years ago he started working at UMC Utrecht to design and develop e-health products. Ever since he has been working on many projects with currently PAZIO as a main focus.

Expert 2 (E2)

E2 is implementation manager at Julius Gezondheidscentra Leidsche Rijn, where he leads the implementation process. Besides, he is involved with the 'Centre of Excellence', a platform developed to share knowledge that was gained during implementations.

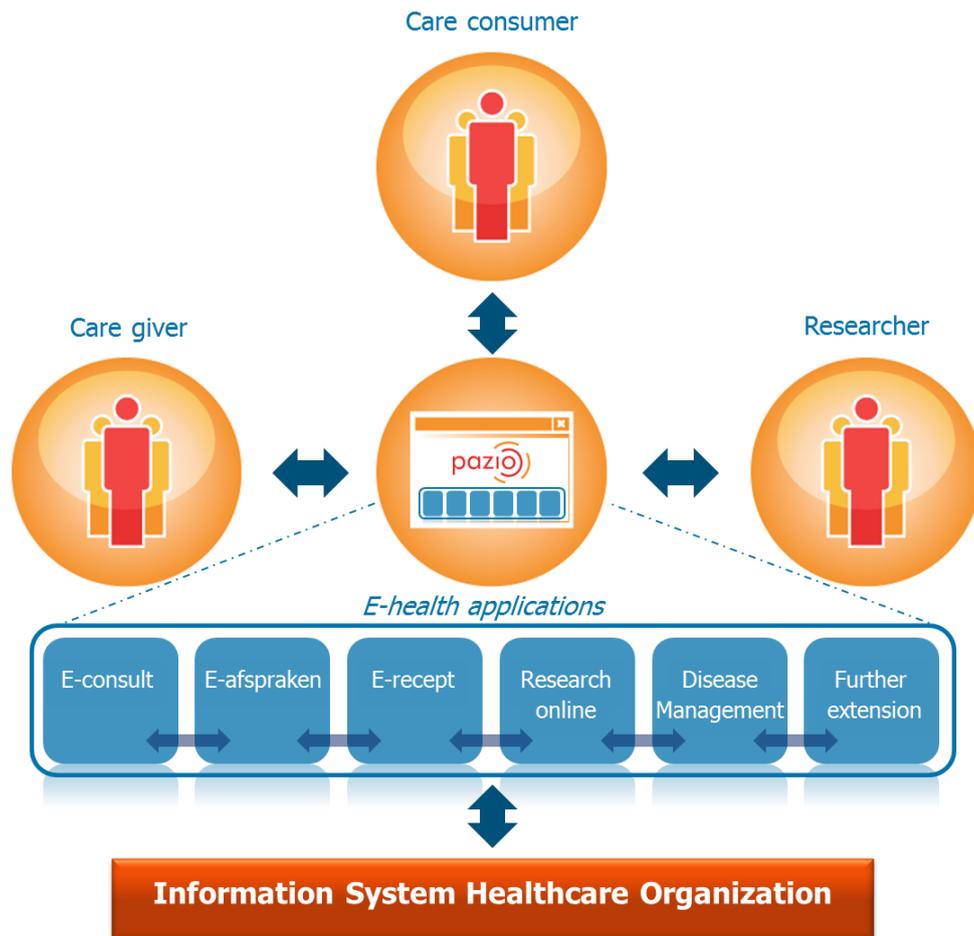


Figure 25 – The PAZIO concept. PAZIO is the central product, while caregivers, care consumers and researchers are the users. External suppliers can provide new apps for the platform and care givers can use their own information system.

INTERVIEW SESSION 2: Health Bridge, a video communication system

Health Bridge is a communication system that facilitates a virtual meeting between GPs and specialists by deploying a high quality videoconferencing system. The system, invented by Wil van den Bosch, lets the GP effectively be available in a hospital or vice versa. The term Health Bridge was carefully chosen, because it characterizes a bridge between primary care and secondary care. It was realized by a collaboration of several parties: Health Valley, ZZG Zorggroep, Telecom4Care and the primary care department of UMC Radboudt. PAL4 was chosen as the technical infrastructure for the video conferences between the professionals.

Benefits

According to Ketelaar, Vreugdenhil and Schers (2010), the increasing demand for personal care and the call for more patient empowerment causes the need for smart innovations. They mention the proven clinical effectiveness of teleconsultation, as well as the advantages of joint teleconsultations for patients. However, complicated reimbursement methods, non-existing protocols and logistic challenges as well as a focus on technology-driven innovations cause a poor public receipt. Therefore, it is important to make such innovations part of an integrated health care system.

As already mentioned, Health Bridge serves both the health care professionals and patients. For patients, a 'time-wasting' referral can be avoided by having the specialist instantly available during

the consult in the general practice. The GP can make an appointment with a specialist preparatory to the consult with the purpose of getting assistance in difficult situations. Vice versa, if a patient visits a specialist, the GP can virtually visit the consult so that he immediately receives feedback. As a result the patient does not need to return to the GP for a feedback consult.

Next to time saving benefits, collaboration between two health care professionals has also a positive influence on the quality of care. For example, if a GP has doubts about a diagnosis, he invites a specialist to be part of the conversation for a second opinion. Also, the system assists in more directed and less incorrect referrals.



Figure 26 – Health Bridge in action. A patient visits a GP, who invited a specialist preparatory to the consult.

Difficulties

The most important problem that health professionals experience is logistics: how to have the GP, specialist and patient present at the same time? This can partially be intercepted by dispense with real-time conferencing. For instance, recording the consult between the GP and patient after which the specialist can watch the video at a moment that suits him. However, these situations do not allow the patient or GP to ask quick questions and receive answers that usually point up during a conversation with a specialist, resulting in a delay of the health episode.

Furthermore, financing has been point of discussion, because no fixed prices are currently determined. In order to realize a nationwide release, agreements with health insurers must be made about structural prices.

Stakeholders in Health Bridge

The actors in Health Bridge are apparent: the patient, GP and innovator are involved during the project. In addition, specialists (i.e. hospital) are also end-users of Health Bridge.

Expert profile

One expert was involved during the interview session on HealthBridge.

Expert 3 (E3)

E3 is cluster manager Healthcare Innovations at Oost N.V. and senior project manager at Health Valley. Oost N.V. is a regional promoting company, an organization that was brought to life to boost

the regional economy with an emphasis on the health care industry. He has been working on e-health solutions for years, and he is specialized in managing and solving complicated problems.

INTERVIEW SESSION 3: ZAHBA

ZAHBA [Zorginformatievoorziening Aan de Huisartsen in het Basiszorggebied van het AMC, *Healthcare information provision to the PCPs in the coverage area of the AMC*] is the practical outcome (i.e. product) of ZONAR [ZOrgNetwerk Amsterdamse Regio], a project that ran between 1999 and 2004 to create a virtual EMR facilitating access for both primary and secondary care professionals. A communication infrastructure was built with the purpose of providing GPs access to laboratory data, microbiological data, ECG, x-rays and letters from AMC patients. Formerly, GPs had to wait at least a week before they received the results. The project's construct concerned two deliverables: (1) a software application with which communication between GPs and specialists could be facilitated in order to let the GP be the only consulting party for the patient; (2) Webhis, a software package that copies GP's medical records to a central database, which makes it compatible to other GP systems.

ZONAR/ZAHBA was originally subsidized by ZorgONderzoek Nederland in which several organizations participated. Currently, ZAHBA is still in use while ZONAR was discontinued after several technical and financial problems. ZAHBA can be accessed by 130 GPs in the region of Amsterdam who own an UZI card.

Stakeholders in ZAHBA

Hospitals and GPs form the main actors of ZAHBA, as well as the innovator. Hospitals make the relevant data available, which then can be accessed by GPs.

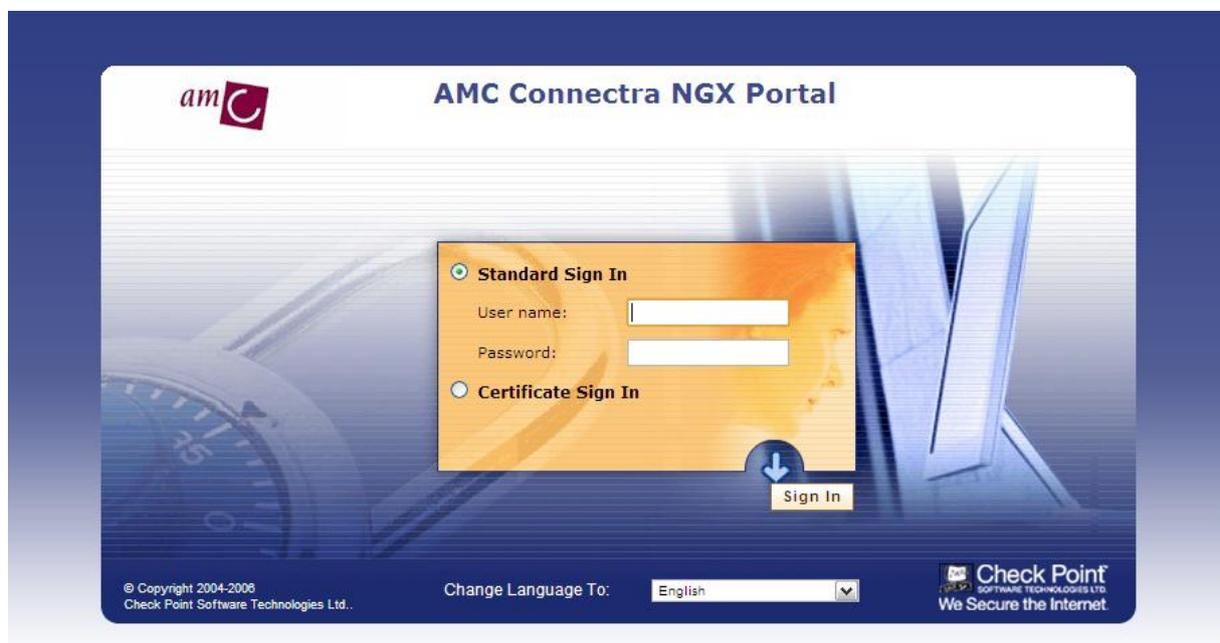


Table 9 – ZAHBA login screen for GPs.

Expert profile

This interview session involved one expert.

Expert 4 (E4)

E4 is a general practitioner in Diemen-Noord and has been involved with several IT innovation projects in the past (e.g. ZONAR/ZAHBA). He is also chairman at Orego, a user group of the GP information system MicroHis.

INTERVIEW SESSION 4: VoeDietist

Dieticians are considered as primary care professionals, i.e. easy accessible care givers. The VoeDietist in Alphen a/d Rijn is a dietician for both overweight and underweight patients. Between episode consults, the patient is asked to submit an extensive online form about his daily nutrition, which provides him insight into the number of calories he consumes and his nutrition habits.

Expert profile

The interview session was taken with one patient.

Patient 1 (P1)

P1, a member of the Vereniging van Spierziekten [Association of Muscle Disorders] has been a frequent visitor of primary care practices, including general practice, a psychologist, a dietician and a rehabilitation physician.

The screenshot shows a web-based form for calculating calories from bread products. At the top, there are summary fields: 'totalen', 'Cal.', 'Eiwit', 'Vet tot.', 'Vet verz.', 'Khd', and 'Alc.'. Below this is a 'Gegevens wissen' button. The main section is titled 'Broodproducten:' and is organized into two columns under the heading 'per stuk'. Each item has a small square input field next to it. The items listed are:

Broodproducten:		per stuk
<input type="checkbox"/> Beschuit	<input type="checkbox"/> Cracker	<input type="checkbox"/> Sanovite
<input type="checkbox"/> Beschuit (volkoren)	<input type="checkbox"/> Croissant	<input type="checkbox"/> Toost
<input type="checkbox"/> Bolletje (bruin)	<input type="checkbox"/> Ger.brood(uit pak)	<input type="checkbox"/> Tosti (Zsnee ham/kaas)
<input type="checkbox"/> Bolletje (krenten)	<input type="checkbox"/> Krentenbrood (snee)	
<input type="checkbox"/> Bolletje (muesli)	<input type="checkbox"/> Knackebröd	
<input type="checkbox"/> Bolletje (volkoren)	<input type="checkbox"/> Knackebröd(maanzaad)	
<input type="checkbox"/> Bolletje (wit)	<input type="checkbox"/> Knackebröd(muesli)	
<input type="checkbox"/> Brood bruin (snee)	<input type="checkbox"/> Knackebröd(volkoren)	
<input type="checkbox"/> Brood volk. (snee)	<input type="checkbox"/> Roggebrood (donker)	
<input type="checkbox"/> Brood wit (snee)	<input type="checkbox"/> Roggebrood (licht)	

At the bottom of the form, there is a 'Subtotaal brood' button and summary fields for 'Calorieën', 'Eiwit', 'Vet tot.', 'Vet verz.', and 'Koolhydraten'.

Figure 27 – Example of a calories counter the dietician refers the patient to. Note that this is not the actual form the patients work with, but a public clone. The actual form is restricted from public access.

PART 2: The experts' vision

Now the innovation characteristics are defined, the next step is to determine the CSFs as explained by the experts. The interview consisted of two parts: (1) an 'open' contribution of additional success factors to the ones already mentioned and (2) the expert's opinion about the success factors found in

literature including a score. This sequence was followed in order to avoid bias, because if the interviewees were informed about the SLR constructs prior to the open questions, they could have been influenced.

Section 1: Success factors and remarks

Prior to rating the findings from literature, the experts were asked about their open minded vision of success of IT innovations in primary care. It resulted in a number of initial factors based on both their experiences in general and the actual innovation they were interviewed about.

Business case

E1 emphasizes the importance of creating a business case in order to make the innovation viable, hence profitable. Many innovators receive grants from the government to develop a new e-health or service. But once they ran out of money and the government closes the money tap, they have to cease their innovation project. Ketelaar et al. (2010), who wrote a paper on Health Bridge, confirm the importance of the business case.

Patient empowerment

E3 emphasizes the importance of focusing primarily on the patient. *“Years ago, Jan Cremer (reproduction expert) started a digital outpatient department with a message board where couples trying to have children could register and have discussions. Besides, it was possible to access test results and additional accreditation information. As a result, couples can be emotional in privacy after reading the test results before going to the consult. Before the existence of this digital polyclinic, the patients heard the test result during the short consult and their respond was very emotional in some cases. The new system increased the patient empowerment, which is an important key to success in health care.”*, states E3. He continues: *“Innovators should take the needs and demands of patients into account when they are working on an innovation. If they refuse to do so, patients are not willing to use the system and the innovation will probably fail. Health Bridge is a typical patient-centered innovation.”* E1 confirms this by stating that *“regarding PAZIO, GPs must relinquish some of their tasks in favor of patients, who as a result have more control about some health processes”*.

Health insurance companies

According to E1, collaborating with health insurance companies is another essential aspect of a successful innovation. Having their support helps to make it financially feasible when those companies decide to partially reimburse the investments. On the other hand, health insurance companies will only invest if they are convinced by the financial benefits of PAZIO.

Product appearance

Another point is to make the product marketable in an early stage in order to make potential investors interested. *“The outside should look like a Rolls Royce, while the inside is still a DAF”*, says E2. *“Besides, end-users will be more positive if the product has a good aesthetic appearance. I even know innovations that are not even built, but an impressive Youtube promo with dazzling animations brings the product to public attention.”*

Prioritizing

E4 mentions the importance of prioritizing, if the innovation was initiated from the academic hospital. *“Projects such as ZONAR failed because too few people were involved. The consequence was that the project had a long duration and as a result it fell into oblivion.”*

Section 2: Expert views on CSFs from literature

Based on our list of CSFs derived from literature (Figure 16), we asked the experts to give their view on our findings without mentioning the frequencies. Hence, we randomly passed the CSFs to every expert and let him comment on it, after which they were asked to give a rating between 1 to 5 (1 meaning 'irrelevant CSF' and 5 'very relevant CSF'). For an explanation of the experts, their profiles were described at the section of the interview guidelines.

CSF	E1/E2 remarks	E1/E2 score	E3 remarks	E3 score	E4 remarks	E4 score	P1 score	Average score
Ease of use Legislation, security & privacy	Do not make the system too difficult.	3	Very important.	5	Very important.	5	5	4.5
	This could be a qualifier or basic assumption, because it is so obvious.	5	Health Bridge tackles this factor by gathering two health professionals, who check each other on high quality data processing.	4	Very important. GPs always consider this as a major problem. The national EMR failed because of this factor.	4	5	4.5
Workflow, productivity & efficiency	Some GPs say that a new innovation takes more work, but this extra time constraint can be intercepted by hiring nurse practitioners for work. In the end, it makes life easier.	4	If an innovator can prove the efficiency gains as result of the innovation, a high adoption rate can be expected.	5	GPs experience new innovation always as work strain. An innovation can save time, but it usually demands a (temporary) investment in time.	4		4.33
User involvement	Very important.	4	Involving end-users during the stage of designing and implementation is critical. GPs must get the impression that they co-invented the innovation, then they will believe in it.	5	Very important.	4	4	4.25
User satisfaction		3	Very important.	5	You are satisfied if something is easy to use. A secondary factor triggered by ease of use.	4	5	4.25
Finance	Very important.	4	Finance is interesting when GPs get a compensation for using the innovation. Health insurers should tackle this problem.	3		5		4
Care quality	If an innovation has confirmed to improve care, nothing can stop it (except financial constraints).	5	Innovations primarily improve the efficiency (i.e. quickness), care can only be improved to a smaller extent.	3	For GPs there is always a trade-off between benefits and deficits of care quality triggered by the innovation. Keep asking yourself: What's in it?	3	5	4
Perceived forecasted value		4	People must have the idea that the innovation solves a problem.	4	The innovation's objectives must be clear, otherwise a GP is not going to use it.	3		3.67
System reliability	If the system is about patient data, this factor is crucial: a qualifier.	5	Nowadays most systems are pretty stable, so this is not an issue anymore, rather a prior condition.	2	If a system constantly crashed, you stop using it. Besides, this factor is not a big deal because you assume that a	4		3.67

Available implementation time Interoperability Guidelines & standardization Incentives Political support Sociability & culture Vendor & provider Competition					system is reliable.			
	4	The time of pilot programs is over. In order to prove a theory, a large-scaled implementation is required.	3	A trade-off is made between the implementation time (i.e. effort) it takes and the benefits.	4		3.67	
	4.5	Connecting between existing HISsen (i.e. GP information systems) is a major issue with regard to PAZIO.	2	It's a stage that usually must be finished, but eventually it is no bottleneck.	4	An average GP does not draw attention to this. Innovators consider this as a problem.	3.5	
	4	Important.	4	We attempt to build upon existing web-based technology. We increasingly draw attention to standardization and guidelines.	2	GPs consider guidelines as something good and beneficial, it is not a barrier.	3.33	
	3	Older GPs close to their retirement perhaps use this as an argument .	4	One should see the particular benefits from the innovation. See also perceived forecasted value	2	4	3.25	
	1	We believe in the power of regional authorities. The national politics do not have notable influence on small innovations.	4	Look at the national EMR failure, the government is very powerful.	4	It's the politics' role to make an innovation financially feasible. If a GP wants to join an innovation, usually the ratings must be modified. Such a change can only be fulfilled by the government.	3	
	1.5	Social and cultural differences determined by generation gaps is disappearing.	4	A positive trend exists, in which GP and patient are more and more acting on the same level. Patients are conducting more self-examinations by consulting health related websites. Hence, this patient empowerment is a cultural trend.	3	GPs always want to do it their own way.	2.83	
	2	This factor is not so important.	4	The era of technology-push is over, a time dominated by providers groundless stating that their system was an all-in-one solution.	2	Innovators take control of this decision.	2.67	
	3		4	Competition between primary and secondary will occur if a primary care innovation is able to perform specific diagnoses, making a hospital referral	1	In The Netherlands, competition between GPs is not an issue.	2.67	

Attitude towards IT			needless.					
	Less important. GPs also understand the need for care improvements, and they understand the importance of IT.	2	People are not afraid anymore for email and Google.	2	The negative attitude towards IT still exists among GPs.	4	2	2.5
Communication	Communication impact will less be of less account in the coming years.	2	This is getting less important.	2	Some basic web technologies such as email between GP and patient are still not a notable part of a GPs daily routine. Moreover, email consultations between GPs and internists barely increased through the years.	3	3	2.5
Knowledge, skill & support	Nowadays IT is no rocket science anymore.	2	IT systems should be self-explanatory. Patients will not use a system that needs support. This factor should not play a key role anymore, maybe it was a key issue in the 80s.	2	GPs want to treat patients, not to play the system manager. Fortunately, software packages have been significantly improved through the years.	3	2.5	2.38
Presence of IT manager	Not relevant. An implementation manager should be more relevant.	3	Not important.	2		2		2.33
Patient access & traveling	No issue in The Netherlands	1	Not relevant.	2	Distance is no problem, but time is a problem!	3		2
Technological & control	Fear for technology is a subject of the distant past.	2	Technology, such as an iPad, has become a product of “just pushing the right button” instead of complicated coding.	2	Not really important.	2		2

Table 10 – Remarks from the experts and patient on the CSFs as determined from the literature. Note that the patient did only comment on CSFs that were relevant for him.

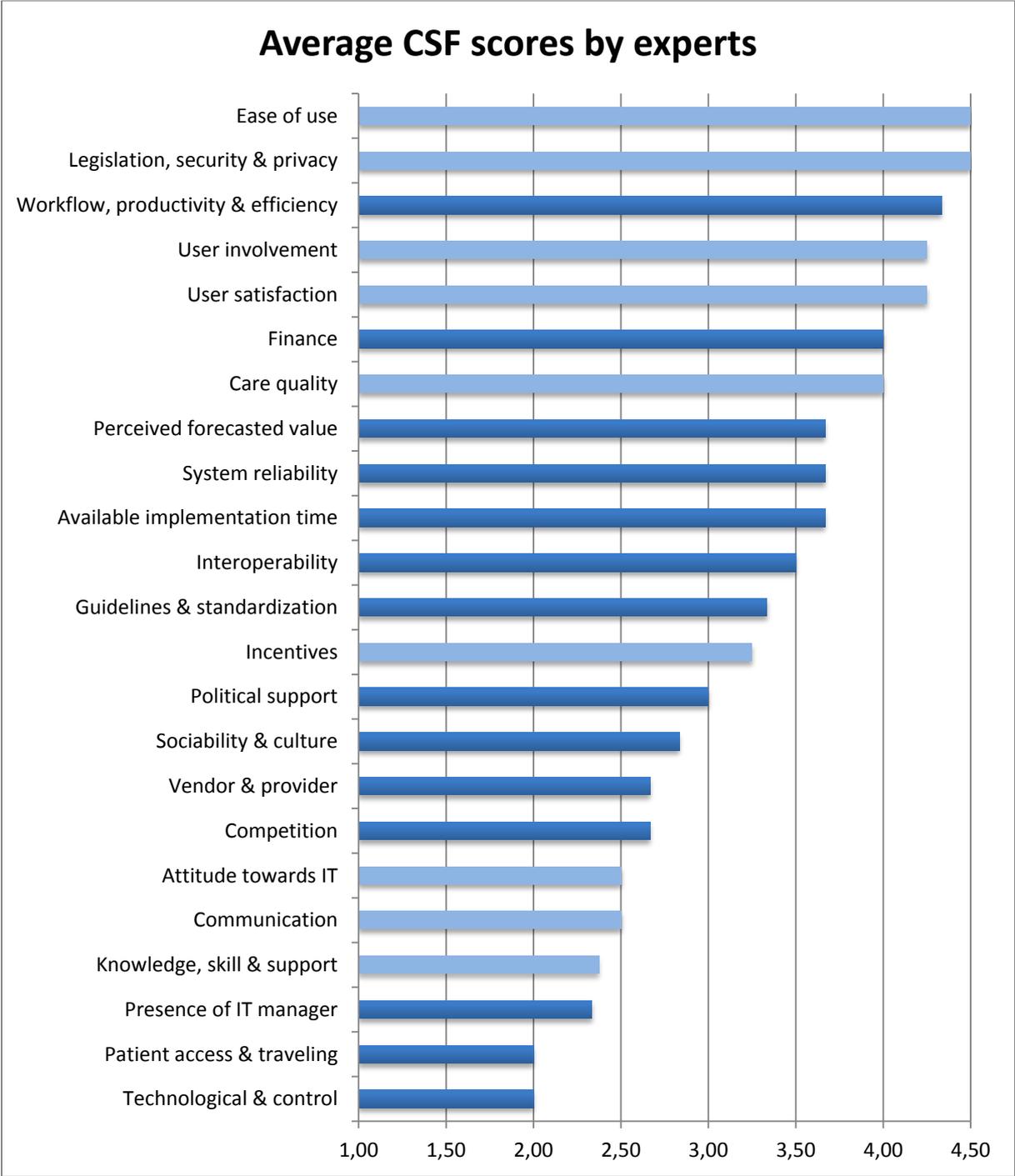


Figure 28 – The average CSF scores as mentioned by the experts. While the dark blue bars were only rated by E1 to E4, the values in light blue are also rated by P1. The CSFs in blue do not apply for patients.

Figure 28 contains the average scores as judged by the interviewees. The total average of the CSFs is 3.3, so every CSF on top of *Incentives* scores above average.

Differences theory and practice

Many theoretical constructs were gained after conducting the interviews. First, *workflow, productivity and efficiency* was confirmed as an important CSF by the interviewees. This was also the case for *finance, care quality* and *legislation, privacy & security*. Although not each of these factors was mentioned in the same extent as in literature, overall it can be stated that those factors had

significant ratings by both literature and practice. Furthermore, a number of CSFs that had low amounts from the SLR frequencies, were also marked as less important by the interviewees, e.g. *patient access & traveling, political support and communication*.

Figure 29 contains the differences between the CSF rankings measured between theory and practice. Positive values indicate an increased 'ranking' compared to the first measurement, and vice versa. For instance, *technology & control* stands 15 positions lower and thus is less important according to the interviewees.

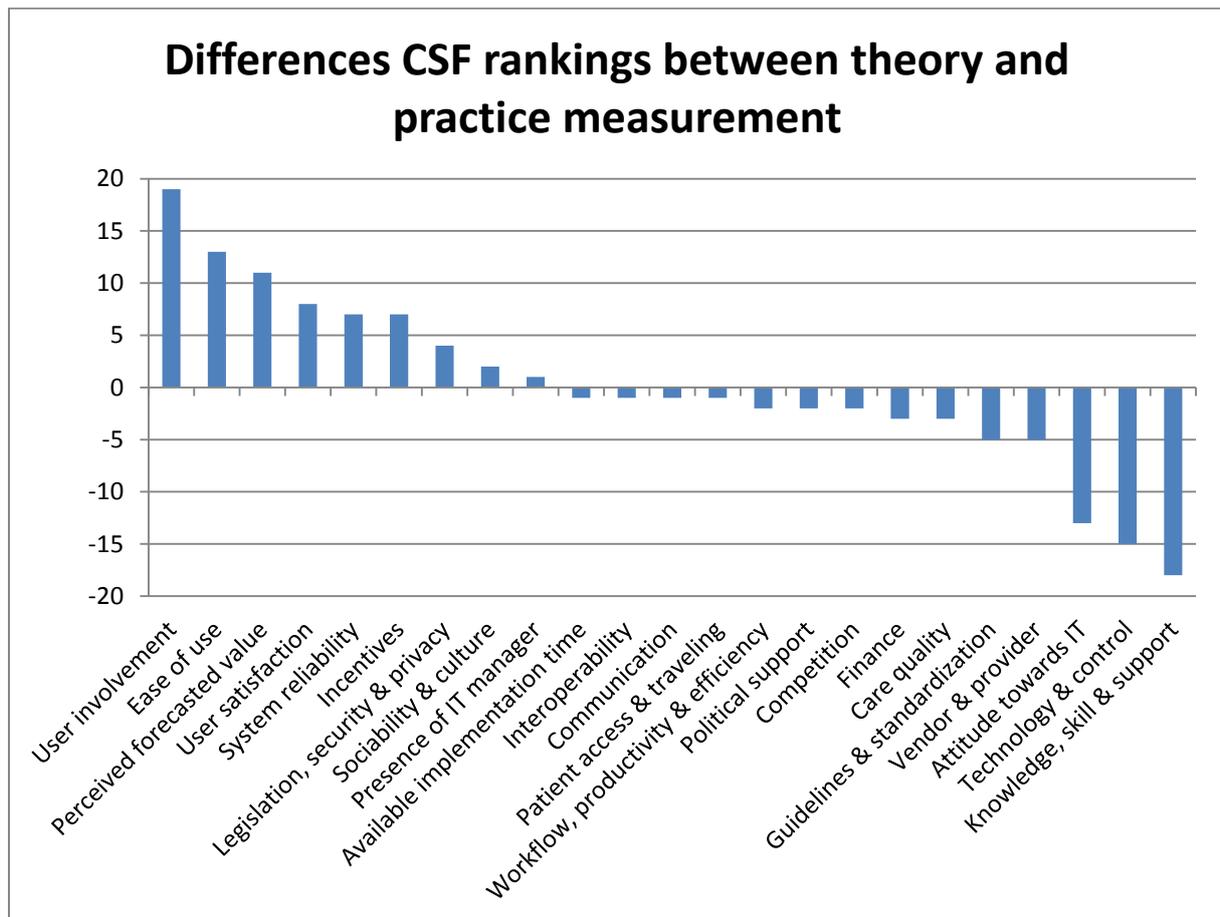


Figure 29 – Variances of the CSF rankings between the first (theoretical) and second (interview) measurement.

Implications for initial FRAMEWORK A and B

The previous section contained interview elaborations regarding four innovations, i.e. PAZIO, Health Bridge, ZAHBA and VoeDietiste. An examination of FRAMEWORK A and B was performed by asking the interviewees their view on involving actors at innovations, innovation stages and the CSFs. We perceived both confirmations and discrepancies about our previous theoretical findings and the derived frameworks.

Notable results

A number of contrasting factors could be obtained. Note that this comparison is based on relative rankings of the CSFs and not the scores, because the theoretical ranking was based on frequencies, whereas the ranking by the participants was determined by a 1 to 5 scale ranking (Figure 29).

First, *user involvement, ease of use, and perceived forecasted value* ascended with more than 10 positions. *User satisfaction, system reliability and incentives* rose a significant number of places as well. The differences between a low score in the SLR and the much higher score by experts can be explained by the obvious and undisputed their characteristic. They exemplify basic assumptions that many studies from the SLR did not mention as CS,F because they are so evident and standardized procedures during innovations.

Second, *knowledge, skill & support, technology & control and attitude towards IT* were not considered as important factors as illustrated by their low scores. This result was somewhat expected due to the trends in Figure 20: the factors were important in the past but nowadays they evidently play a less significant role. Furthermore, *guidelines & standardization and vendor & provider* were also considered as less important by the respondents than stated by the SLR construct.

Reconsidering FRAMEWORK A

Based on the findings from practice we are able to reassess the two frameworks as presented previously. Not only the new CSF ratings were taken into account, but also the expert visions on the innovation stages and SDLC, qualifiers/prior conditions and actors.

Framework discontinuation

The initial plan was to create two frameworks in order to get insight into both the innovation stages and the links between the different actors in relation to the CSFs. FRAMEWORK A, based on the SDLC, was criticized by both E1, E2 and E3. E1 notices: *“PAZIO is a never-ending story. It is rather a service than a product and it will be extended and changed through the years. For this reason, we can not easily state that there are a number of fixed innovation stages. PAZIO follows an iterative and incremental development process”*. Hence, the interview sessions learned that innovating is not only a matter of proceeding through sequential stages, because large innovations follow a more complicated, ever ongoing innovation structure involving many stakeholders. Following the steps from the SDLC is only relevant in specific cases, hence we determined to drop this vision for the next framework. As a result, we decided to discontinue FRAMEWORK A.

Accordingly, our perception on innovating stages did not get any support by the interviewees, because it is not possible in this research to examine every type of innovation on the model for the reason that it always depends on the project size. Afterwards, we can conclude that selecting the software development life cycle as a basis for stage distinction was not a successful choice.

Consequently, the development of FRAMEWORK A has discontinued, while the first version is still accessible as a reference (Appendix B).

Reconsidering FRAMEWORK B

The original actor-based FRAMEWORK B focused on the connections of the CSFs in relation to the different roles. In contrast to FRAMEWORK A, the experts believed in the viability of FRAMEWORK B because it gives a better impression of how IT innovations in primary care are conducted compared to FRAMEWORK A. A number of adjustments were made to the model as a result of the practice interviews.

CSF reassessment

Based on the interviews, we decided to decline a number of CSFs (e.g. *Attitude towards IT* and *knowledge, skill & support*), while new ones are introduced as well (e.g. *Patient empowerment* and *business case*). These decisions were primarily made as a result of Figure 29 and the remarks by the experts.

Qualifiers

As E1/E2 and E3 mention, some factors are rather basic assumptions for each type of innovations than primary care related CSFs. Therefore, we decided to regard *ease of use, legislation, privacy & security, user involvement, finance, system reliability* and *incentives* (along with *perceived forecasted value*) as qualifiers. Figure 30 shows the six qualifiers in the semicircle, which functions as an 'umbrella' of the innovation, i.e. prior conditions.

The addition of these qualifiers mean that, if they are not taken into account during an innovation process, the innovation would always fail.

Actors

Another construct of the interviews was the view on actors: not only innovators, GPs and patients are involved during the innovation, but several external parties as well, namely local or national politics, vendors and health insurance companies. Moreover, the innovator should not always be considered as a single associate, because it can also consist of several contributors responsible for the realization of the innovation. For this reason, 'innovator' gets a plural form. The three main actors are illustrated in Figure 30.

Replacing the central object

In FRAMEWORK B, the roles were centered around the IT innovation. It was decided to remove the innovation as part of the framework, because it could better represent the framework as a whole. The IT innovation was replaced by the innovator as the central actor of the innovation.

Figure 30 represents the revised framework, which mainly builds upon FRAMEWORK B. The actors are surrounded by the six qualifiers. Although the GP and patient have their individual connection with the innovator, they both share the care quality factor for the reason that they are the enablers of good care quality. Furthermore, the innovator also needs to take into account the guidelines & standardization and operability. Although finance is a qualifier, the business case should also be initiated and realized by the innovating party. Finally, external actors (i.e. health insurer, vendor and politics) can play a role during the innovation process, depending on the context.

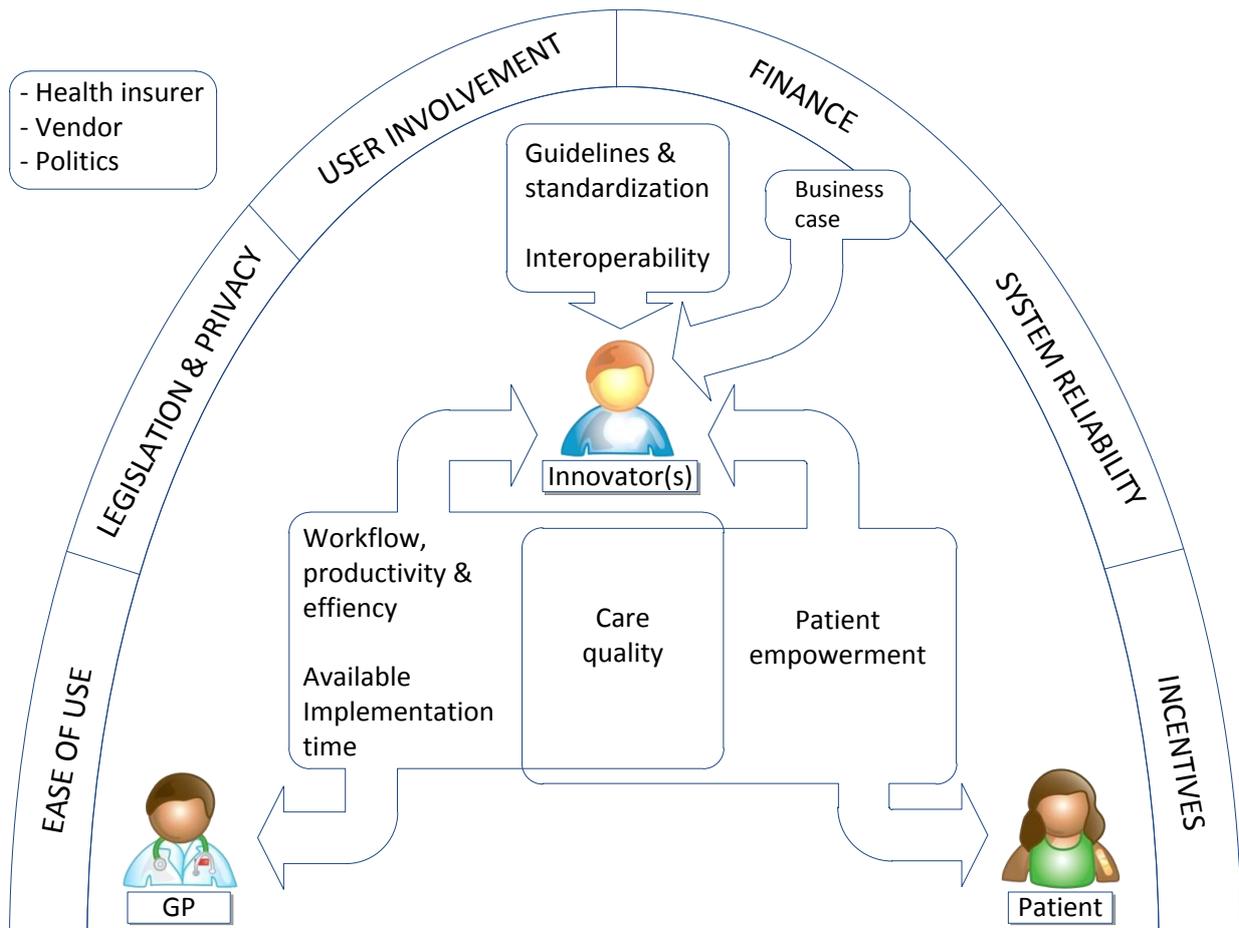


Figure 30 – Revised Framework B.

Summary & conclusion

This section exposed a number of experts' visions in relation to the frameworks constructed subsequent to the SLR. The interviews were divided into two separated parts and each part had some notable outcomes. First, the open minded questions learned that the experts attach importance to topics such as patient empowerment, business case, the role of health insurance companies, product appearance and prioritizing. Second, the experts examined the CSFs and the original frameworks after which some suggestions were given.

Framework A

Based on this first session of expert interviews, it was determined to discontinue FRAMEWORK A for two main reasons:

- The use of stages did not get sufficient support, because the stages of innovating differ too much between projects as a result of different project size and type of innovation, according to the experts.
- The classification of the CSFs is a debatable process, i.e. spreading the factors over the SDLC innovation stages does not result in an unambiguous composition. Some factors cover more than one stage (e.g. *ease of use*) or are rather a stage requirement than a process (e.g. *presence of an IT manager*).

Framework B

In contrast to the discontinuation of FRAMEWORK A, FRAMEWORK B was considered as relevant and useful according to the experts. They had some correctional remarks and they gave some advice for framework improvements as well. One important difference is the alteration of the model perspective: in the revised version the innovation is not a particular element anymore, the model itself represents the whole innovation process. Other major improvements including their reason for adjustment:

- *Knowledge, skill & support* and *Attitude towards IT* were removed from the framework, because the experts judged these factors as not relevant enough which is consistent with the given CSF score.
- A new group of very important factors (so-called 'qualifiers') was made, consisting of the factors *Ease of use, Legislation & privacy, User involvement, Finance, System reliability* and *Incentives*. A very high CSF score for each factor on the one hand, and the a specific mention by experts to emphasize the vital interest on the other hand, are two main reasons for the construction of this group of CSFs.
- In addition to the GP, patient and innovator, a third and less defined group of external parties were added as a fourth actor. The influence of third parties (e.g. politics and health insurers) can play both as enabler or disabler of an innovation project, according to the experts.

The next chapter consists of senior expert interviews who present their view on the revised version of FRAMEWORK B (Figure 30).

CHAPTER 4B – Validation interviews

The previous section elaborated on the adjustment of the initial frameworks, where only FRAMEWORK B was preserved as a construct from the practice interviews. The next step involves the evaluation of the framework by senior experts. It is done by interviewing with a slightly different focus compared to the first interviews. Instead of concentrating on the CSFs from the systematic review, the emphasis of this second round is on the framework revision (Figure 30).

According to Baarda et al. (2003), triangulation is a good method to evaluate outcomes in qualitative research. Triangulation is a technique that requires at least two measures from different perspectives in order to get a more accurate picture of the situation. In our case, we initially asked field experts how the theory applied to practice. These experts are involved in the daily practice of IT innovations in general practice and are considered as the first measurement. A good second measurement entails the examination of the results by interviewing senior professionals who left their mark on the health care industry in any valuable way.

Similar to the previous chapter, we followed the guidelines from Baarda et al. for the execution of the interviews.

Interview candidate selection

The interviews were executed in two sessions with senior experts, i.e. professionals in health care who have decades of experience in health care and also have affinity with primary care and IT in particular. Both experts work at organizations founded to control parts of the Dutch health care and primary care industry in terms of planning, capacity, policy, education, finance, etc. Hence, they generally have a good view on the situation of IT in Dutch primary care.

Actor (role)	Interviewee (anonymous)	Organization	Location
Senior policy maker	Senior Expert 1	Capaciteitsorgaan	Utrecht
Senior staff member	Senior Expert 2	Nederlands Huisartsen Genootschap [NHG]	Utrecht

Table 11 – Profiles of the senior experts.

Expert profiles

Senior Expert 1

Senior Expert 5 [SE1] is senior policy maker at the Capaciteitsorgaan in Utrecht. He was trained as a physician, in a time when there was an oversupply of GPs on the market. He started working in practices that were accompanied by a pharmacy. Next to his interest in health care, he was also a devotee of the new pioneering world of IT and automation. His work slowly shifted from health care towards implementation of IT systems, because many software builders did not have the required knowledge of health care. After years of work in the automation of health care organizations, he acquired a lot of unique knowledge and experience.

Senior Expert 2

Senior Expert 2 [SE2] is a physician who got in touch with IT while performing tropical medicine. In the 1980s he was in Africa for the design and implementation of an epidemiological management instrument and became expert on the area of standardization and ICT at NHG.

Interview design

Compared to the previous interviews, the new ones were not focused on reassessing all the measured CSFs again, but rather on the evaluation and possible validation of our final framework (Figure 30). Similar to the first interview round, we conducted semi-structured interviews (Baarda et al., 2003, p. 133-134), roughly divided in three parts:

- An introduction of the experts' background. They were asked to tell something about their work in health care and affinity with IT.
- A part containing some supporting questions before evaluating the final framework. For example, the list of CSFs was discussed.
- The last and most important part, focusing on the final framework.

The sequence of open questions prior to the closed questions was carefully chosen in order to avoid bias by the experts. Providing the CSFs and framework before posing open questions on success of IT innovations in general practice could influence the experts unintentionally.

A few days before the interview, the experts were sent a summary of this research to date with the purpose of being able to have a sufficient preparation.

Interview execution

The two participants were visited at their organization, hence a face-to-face setting. The semi-structured interview technique leaves room for concise side paths, anecdotes in order to let the respondent feel that he was having an actual conversation rather than interview. A smartphone was used to record the conversation.

Interview analysis

The analysis of the interview involved the creation of a transcript. As before, we used the free software tool Express Scribe to make a transcript of the interview. For the next step of labeling interview data we decided to use software to automate certain parts of the process, namely NVivo9 (Figure 31). With NVivo9 we were able to create labels, so-called nodes, to seek for similarities between the two interviews. These nodes consist of information blocks that form a single entity

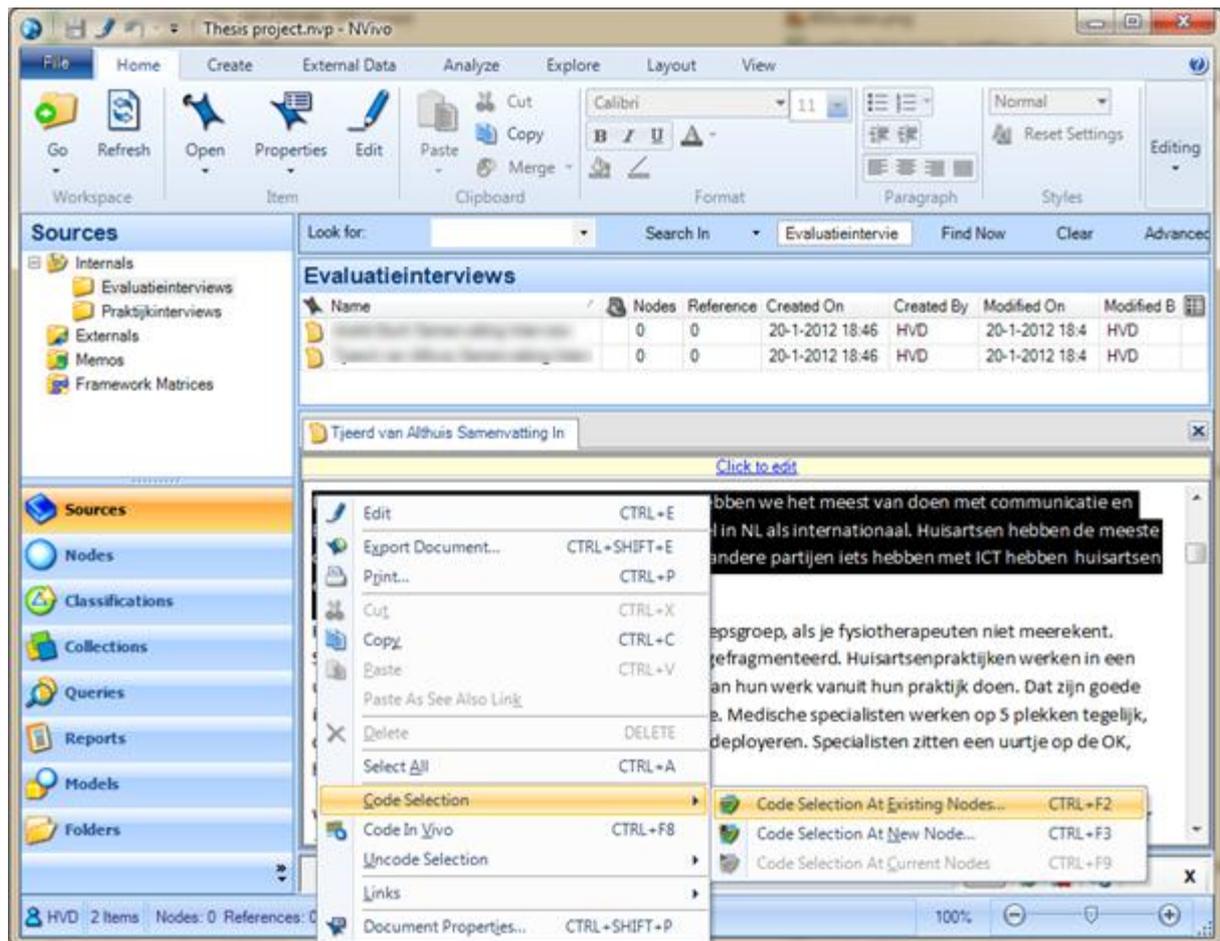


Figure 31 – NVivo 9, software to organize research documents and automate a number of actions, such as labeling.

Interview results

SE1 and SE2 were asked to give their opinion about health care and the role of IT that tackles or creates problems. The experts were informed about the initial frameworks (A & B) and also the revised version of FRAMEWORK B.

PART A: Experts on CSFs

With regard to the initial frameworks, SE1 has some critical notes. Although he approves most of the CSFs, he has his doubts about the importance ranking that was based on the literature findings, and hence the first outcomes of the frameworks. SE1: *“It’s a typical standard list of factors that you can find anywhere”*. He also noticed the low positions of user involvement and user satisfaction, compared to less obvious CSFs such as interoperability. In contrast, SE2 responded more positive: *“I understand most of the CSF positions. It is true that ease of use and user involvement are important issues, but efficiency and finance are way more vital.”* According to SE2, IT innovations will be used despite bad ease of use, because money plays a more important role. *“Money has always been a driver, if you like it or not.”*

Both senior experts were not surprised by the contents of the initial frameworks, but SE1 disagreed with the initial importance ranking of the factors, while SE2 said he understands why the positions of the CSFs of the frequency table.

PART B: Experts on final framework

The last and most important step was to let the experts give their opinion about FRAMEWORK B (Figure 31).

External actors

SE1 about external actors: *“Make sure you keep them as far away as possible from innovation projects. Speaking from my own experience, you’d better completely ignore external parties and focus on the primary process. That is what’s important. Practice, the workers, they enforce the necessary steps that must be taken.”*

SE2 complements by stating that *“the Dutch government sometimes tends to throw everything into the market, and looks what happens”*. Furthermore, he says *“The field of healthcare wants more uniformity regarding communication with secondary care. [...] Regarding IT innovation, we should start with national standardization. From there it is possible to start implementing regionally and locally. [...] Another problem is that too many policy makers and decision makers have no idea about which they are making decisions. That is really outrageous”*.

Both senior experts have a clear opinion about external actors, which confirms the essence of having them positioned in the model: putting effort in keeping them away means it is important to take them into account.

Qualifiers

“The qualifiers are basically well chosen, but there can be discussion about which factors to include or not. Recently I read a paper on the implementation of an EMR at Kaiser Permanente, and the reason why it failed was lack of user involvement.”, confirms SE2. He continues: *“I notice a connection between incentives, finance and business case. Considering the Spider Awards, none of them is successful because they lack a good business case”*. The emphasis on the business case could indicate that it is a very important CSF, conceivable a qualifier. The revised version of FRAMEWORK B showed a small overlap between finance and business case, indicating that business case is close to be a qualifier.

SE1 mentions the importance that a system must always be running (i.e. system reliability) and that it must be feasible (i.e. finance). He also states that the privacy problem exists: *“At the ministry they have the illusion that every security problem can be fixed.”* Moreover, SE1 also confirms the precondition of incentives: *“We convinced a pharmacist that the turnover increases as a result of automation”*.

Overall, the two experts are positive about the qualifiers. Although they imply it is difficult to confirm that the list is complete, they endorse most of these very important factors that are included. An exception to this is legislation and privacy. Notably, both experts did not mention this qualifier in their arguments.

Actors

SE1 and SE2 both approve the three primary actors in the model. SE1 says that *“these roles work well as long as each actor does not try to be the other one.”* SE2 confirmed the existence of the actors, as

long as they can be widely interpreted. For example, the innovator can be a big party or a single person.

Notably, both experts put an emphasis on the innovator and GP and did not mention the patient. It can therefore be concluded that they believe the patient is less important than the GP and innovator.

Critical success factors

Both experts have some remarks on the CSFs in the model. *“Business case is well chosen, because when I think about innovating I think about a business case. Creating money enables viability”*, according to SE2. SE1 states that *“workflow, implementation time and guidelines”* play an important role, but he says *“these factors are not as important as, for instance, ease of use”*. This is in contrast with SE2, who pronounced that ease of use is a subordinate of workflow & efficiency and finance.

Also, both experts emphasize that workflow & efficiency issues are main drivers for innovating, and not the quality of care, because it is perceived in practice that the care quality is already at a good level. It is therefore questionable if care quality is really a CSF, or perhaps an ‘accidental but nice touch’.

Additional CSFs

SE1 created his own list of factors: *“(1) knowhow, (2) clear responsibilities, (3) unambiguous definitions and (4) ease of use.”* Knowhow can be gained by involving the right people in the project (user involvement). SE2 agrees to this: *“Knowhow, that is currently lacking.”* Ease of use is a literal match with our framework. The other factors are derivatives from project management. These issues could be considered for an adoption into the framework. In addition, *“national standards for IT implementations in regions should be realized”*, as said by SE2. Both SE1 and SE2 refer to expectations management that is missing or misunderstood.

- A difference in the valuation of some CSFs between the experts shows that there is no uniformity about these factors. SE2 prefers finance over all the other factors, while SE1 believes more in ease of use.
- In addition to FRAMEWORK B, both experts independently posed two other factors they consider as critical: knowhow and expectation management. In future versions of the framework these potential CSFs should be taken into consideration.

Overall, the experts generally had a good feeling about the revised version of the framework, but they left room for extension. Their suggestions for some basic framework improvements and uncertainty about its completeness, enforce us to conclude that the revised version of FRAMEWORK B could not completely be validated. However, there was enough support to use the framework as a good starting point to modify and extend for future research.

CHAPTER 5 – Conclusion

This section contains the conclusion of this research, along with a brief discussion and recommendations for future research.

Answers to the research questions

At the introduction of this research we presented our main research question:

“Which critical success factors can be found in scientific literature about IT innovations in Dutch general practice which are developed to improve productivity, efficiency and labor savings and how can this overview be used for a framework that can be applied in practice?”

This research question was divided over four sub questions, which will be answered in this section.

Sub question 1: collecting publications

“What publications about IT innovations in general practice focusing on productivity, efficiency and/or labor savings can be found in scientific literature worldwide and in The Netherlands?”

Our first mission was to map scientific literature about success at IT innovations in general practice. The method we used to gather a relevant collection of sources was by means of an extensive systematic literature review. We strictly followed guidelines by CRT (2009) which resulted in a search query that was executed on four scientific databases, i.e. Google Scholar, Web of Science, EconLit and Scopus. The 1451 search results were collected in a database in order to conduct a filter procedure on publication title (n= 197), abstract (n=80) and content (n=58). These 58 remaining papers were put through a structured data extraction, e.g. innovation type, research purpose, publication year and, of course, critical success factors.

The publications about IT innovations were gathered in an extensive table (Table 13).

Sub question 2: critical success factors

“Which critical success factors can be extracted from those publications and how can they be modeled for practical use?”

The second endeavor was the classification of the CSFs based on the discovered literature. The publication table (Table 13) contained 212 measured CSFs, which were categorized by using a bottom-up organizing procedure. As a result, 23 CSF categories remained (Table 6).

A number of basic analyses were performed on the results of the systematic review, leading to some interesting figures, e.g. Figure 19 and Figure 20. These results were used to determine ways to model the CSFs. Two models were constructed:

- FRAMEWORK A (Table 14-Table 16): focusing on the different stages of innovation over which the CSFs are divided, based on the stages from the system development life cycle.
- FRAMEWORK B (Figure 22): focusing on the different actors that get involved during an innovation project.

Each framework has its specific approach at which the CSFs are projected, which adds value to the usefulness of the CSFs in a different way.

Sub question 3: first expert interviews and first validation

“To what extent can the framework(s) be validated by experts from practice?”

The purpose of this question was to learn how experts from practice think about our findings (i.e. CSFs) from literature. We selected 3 innovators, 1 GP and 1 patient, each having experience with one or more IT innovations in general practice: PAZIO, Health Bridge, ZAHBA and VoeDietiste. They were asked to give their view on the list of CSFs we presented and the two frameworks.

The experts were clear: IT innovation projects in general practice have basically no default stages to go through, because the procedures for innovating depend on project size and involved parties. The field of IT innovations in general practice is too comprehensive to specify innovation stages. Therefore, FRAMEWORK A was discontinued.

On the other hand, the experts said that FRAMEWORK B was potential but it should be better specified. Thus, the model was not finished yet, it needed some modifications. The interview sessions learned that two types of CSFs should be distinguished according to the experts, namely preconditions (basic assumptions) and CSFs. Besides, the experts thought that the placement of CSFs between the different actors (i.e. roles) could be better specified. Another point of discussion was the absence of these findings were taken into account with regard to framework revision.

Sub question 4: framework enhancements and validation interviews

“How can the findings from the interviews be used to enhance and complete the framework(s)?”

The next step was to improve FRAMEWORK B based on the input from the experts. Figure 30 shows the revised version of the framework, which results in significant alterations compared to the early version (Figure 22). First, the preconditions are presented in a bow (‘umbrella’) that covers the innovation, consisting of former CSFs. Two new elements are introduced as CSFs, namely *Business case* and *Patient empowerment*, because these are the only factors suggested by more than one expert. Third, external parties are shown as they can play a key role during an innovation project. The findings by experts assisted in bringing FRAMEWORK B to a higher level in terms of completeness.

After the modification to our final framework (FRAMEWORK B), an examination by senior experts was performed. These new interview sessions complement the first sessions in two ways: (1) the revised framework was reviewed instead of the former ones and (2) the experts have many experience on policymaking in health care compared to the ones from the first session.

The purpose of these interviews was to evaluate and validate the revised version of the framework (Figure 30). In general, the experts were positive about the final framework, but had some remarks on specific parts of it:

- External actors should be ignored in order to not interrupt the primary innovation process, hence the model should better visualize this. Besides, it would be beneficial to split up the external actors as separate elements, as each external actor has its own connection to the innovation.

- Legislation & privacy is probably not a qualifier but a regular CSF.
- According to the senior experts, the role of the patient is less important than the framework implies.

Limitations

This research copes with a number of circumstances that is against but does not apply to this research, i.e. limitations.

Definitions

The first limitation is that clear definitions between and within health care systems make it complicated to get a complete and reliable view on Dutch general practice. Although we attempted to severely define our scope and restricted the research to general practice only, many literature sources were not very particular in their definitions on general practice and primary care. Besides, differences between national health care systems create problems in terms of uniformity. How do we know whether research from Croatia can be compared to research from the US and The Netherlands? We put effort in avoiding these situations by filtering the sources during the SLR on modern Western health systems or not.

Representation

Another limitation is the extent to which our research can be generalized to general practice in The Netherlands as a whole. Although the investigated innovations were relevant within the sector, the number of innovations do obviously not cover the entire field of Dutch general practice. This study was not designed to do representative statements, because we entered a relatively unexplored research area about which is not much known. A recommendation for future research is to focus on scope expansion in order to increase the representativeness of the research.

SLR issues

A critical decision during the SLR execution is the establishment of the search queries. It is very difficult to determine whether or not a search query is sufficient, because it is not feasible to view all the results beforehand. One can only state afterwards that the queries resulted in useful sources and hence a satisfying continuation. Although we believe the used search queries are sufficient, we had no tool for confirmation. Future SLR studies could draw attention to this more extensively in order to increase reliability.

In addition, the choice for a classification of 23 CSFs is debatable. Our decision to perform a bottom-up method resulted in a high number of categories. Future research is needed to determine which factors eventually can be merged.

Implications for practice and future research

Although our final framework received some positive remarks from the senior experts, it is not completely finished yet, i.e. model extensions and minor modifications are needed to refine the framework. Since our research can be considered as a pioneering study, it is not unusual to suggest improvements for the future. We made a first effort in generally mapping the CSFs of IT innovations

in general practice, and our final framework should be regarded as a starting point and ready for further elaboration.

Innovation types

A recommendation for a follow-up study is to include the innovation types into the model, or, if necessary, to construct separate frameworks for all innovation types. It requires an in-depth research into each separate innovation type, which would probably produce framework versions with different spotlights. Besides, such a model is more specified and therefore provides more pragmatic assistance for innovators.

Perspectives

Another suggestion is to create new frameworks based on the three different perspectives, thus having a framework for innovators, GPs and patients. FRAMEWORK B is currently designed to use for innovators, but having a model from the perspective of a health professionals enables GPs to better understand their position in the innovation process. Even a framework from the patient's perspective would help researchers in identifying the needs and key aspects of their role.

Practical use

Our deliverable, FRAMEWORK B, was originally designed to guide innovators, for instance hospitals and small innovation companies. If an organization decides to initiate an IT innovation project in general practice, FRAMEWORK B can assist them in understanding which factors are important at a particular moment during the innovation. Furthermore, the qualifiers are very important CSFs that must get attention in an early stadium. Consequently, studies or consults on ease of use, user involvement, legislation & privacy and system reliability are needed prior to the start of the project. It is also important to know if the innovation actually attempts to solve an existing problem and is no technology-driven project, because otherwise there are no incentives by the involved actors. At last, a solid budget is needed to fund the project in order to make it happen from the start to the end (i.e. deployment). In addition, it is recommended to also keep in mind the business case. If the innovation is not profitable, the reason of existence will be at stake.

Research institutes can use the framework to further elaborate on the findings and to improve it on the aspects of innovation type and perspective.

Stakeholders, such as health insurers, can use the framework as a project overview to understand why and how they can financially contribute to an IT innovation. Stakeholders should emphasize the need of a solid business case in order to know how money is made and how the workflow and efficiency gains make a specific task less expensive, hence interesting to support.

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Appendix A

Legend of content extraction table

Innovation type	EMR = Electronic Medical Record; VC = Virtual Consultation; EP = Electronic Prescribing; RPM = Remote Patient Management; ER = Electronic Referral; CDSS = Clinical Decision Support System; OPP = Online Patient Portal; PP = Process and Programmatic Action Evaluation and Management System; NS = Not Specified
Research area/scope	MC = Medical Care (general); PC = Primary Care (semi-specific); GP = General Practice (specific)
Country	US = United States; AU = Australia; CA = Canada; UK = United Kingdom; FI = Finland; NO = Norway; NL= The Netherlands; DK = Denmark; NZ = New Zealand; CY = Cyprus; SI = Singapore; NS = Not Specified; VA = Various countries
CSF category	1 = Workflow, productivity & efficiency impact; 2 = Attitude towards IT; 3 = Knowledge, skill & support barrier; 4 = Financial impact; 5 = Quality concern; 6 = Interoperability; 7 = Guidelines & standardization; 8 = Competition impact; 9 = Communication impact; 10 = Legal, security & privacy concern; 11 = Social & cultural impact; 12 = Technological impact & control; 13 = Vendor & provider issues; 14 = Political support; 15 = Time concern; 16 = System reliability; 17 = User satisfaction; 18 = Perceived forecasted value; 19 = Ease of use; 20 = Incentives concern; 21 = Presence of IT manager; 22 = Physician involvement in development and/or implementation; 23 = Patient access and/or traveling impact;

Table 12 – Legend of SLR table.

Content extraction table

#	Innovation type	Research area/scope	Country	Innovation & research purpose	CSF category	Critical success factors/ barriers
1	EP	PC	US	Evaluating an electronic prescribing tool.	1, 2, 4, 18	Seven findings, ranging from positive to negative: (1) EP is effective, (2) EP can be the harbinger of new practices, (3) EP drives the clinical workflow, and (4) EP is sometimes seen as a necessary evil/unwelcome disruption. Agarwal, R., Angst, C.M., DesRoches, C.M. & Fischer, M.A. (2010). Technological Viewpoints (Frames) About Electronic Prescribing in Physician Practices. <i>Journal of the American Medical Informatics Association</i> , 17(4), 425-431.
2	VC	PC	US	To find out the factors that determine the adoption of e-detailing.	2, 3, 8	Notable factors significantly influencing the adoption involve (1) relative advantage over traditional detailing, (2) years in practice and (3) attitudes (e.g. confidence and understandability). Alkhateeb, F.M. & Doucette, W.R. (2009). Influences on Physicians' Adoption of Electronic Detailing (e-detailing). <i>Informatics for Health and Social Care</i> , 34(1), 39-52.
3	VC	GP	US	"To assess [family medicine] provider satisfaction with VCs via e-mail survey".	1, 4, 5, 10	Providers say it provides good care, is cost-effective and efficient. Barriers include medicolegal concerns, impersonal process discomfort, fear for high workload. Angstman, K.B., Adamson, S.C., Furst, J.W., Houston, M.S. & Rohrer, J.E. (2009) Provider Satisfaction with Virtual Specialist Consultations in a Family Medicine Department. <i>The Health Care Manager</i> , 28(1), 14-18.
4	EMR	PC	CA	To improve the adoption of an EMR system in Canada.	1, 4, 10, 12	Critical issues to adoption: (1) facilitating conditions (financial risk), (2) social influence (psychological risk), (3) performance and effort expectancy (performance risk), (4) legal and privacy issues. Archer, N. & Cocosila, M. (2006). Improving EMR System Adoption in Canadian Medical Practice: A Research Model. <i>Proceedings of the 2009 World Congress on Privacy, Security, Trust and the Management of e-Business</i> , 121-132.

#	Innovation type	Research area/ scope	Country	Innovation & research purpose	CSF category	Critical success factors/ barriers
5	EMR	PC	US	Determine the factors for the adoption of IT in small physician practices	1, 3, 4, 7, 10, 15	Barriers to adoption: (1) start-up costs, (2) lack of uniform standards, (3) lack of time, (4) maintenance costs, (5) lack of evidence of effectiveness, (6) privacy concerns, (7) lack of training.
				Audet, A.M., Doty, M.M., Peugh, J., Shamasdin, J., Zapert, K. & Schoenbaum, S. (2004). Information technologies: when will they make it into physicians' black bags? <i>Medscape General Medicine</i> , 6(4), e2.		
6	EMR	PC	US	Define the barriers to the readiness of physicians for EMRs.	3, 4, 6, 10, 13	Barriers: (1) reimbursement, (2) lack of interoperability, (3) practical issues (training, privacy, maintenance, vendor choice).
				Bates, D.W. (2005). Physicians and ambulatory electronic health records. <i>Health Affairs</i> , 24(5), 1180.		
7	NS	PC	US	General approach on improving the practice of primary care, including a view on the contribution of IT.	1, 5, 7	Potential IT solutions and corresponding benefits: E-Prescribing (reduced medication errors, improved physician performance), Reminder systems (improve physician compliance with guidelines, improving routines for e.g. immunization and diabetes care), Physician feedback (improving process and outcome measures in long-term care), Patient self-management on chronic illness (improving physical exercise).
				Bodenheimer, T. & Grumbach, K. (2008). <i>Improving Primary Care: Strategies and Tools for a Better Practice</i> . New York: McGraw-Hill.		
8	VC	PC	US	To determine the barriers to the adoption of email consults between physician and patient.	4, 5, 7, 10	Barriers involve (1) lack of reimbursement, (2) potential increased workload, (3) data privacy maintenance and security, (4) avoiding increasing medical liability and (4) uncertainty about quality of care.
				Bokus, E.R., Grossman, J.M. & O'Malley, A.S. (2010). Physicians Slow to Routinely E-mail With Patients. <i>Center for Studying Health System Change</i> , 134.		
9	EMR	PC	US	Elaborating on the success and barriers of EHR use by physicians, as well as acquiring some testing data from practices.	1, 3, 4, 10, 11, 12	"The barriers to EHR adoption were found to be [...] (1) capital cost of EHR, (2) cost in time (to the users), (3) security or confidentiality issues, (4) cost to maintain EHR, (5) interference with doctor-patient relationship, (6) difficulty with learning new technology, (7) lack of technical support, (8) lack of control over technology choices, and (9) lack of perceived benefits from computerization."
				Clayton, P.D., Narus, S.P., Bowes, W.A., Madsen, T.S., Wilcox, A.B., Orsmond, G., . . . Leckman, L. (2005). Physician Use of Electronic Medical Records: Issues and Successes with Direct Data Entry and Physician Productivity. <i>AMIA Annual Symposium Proceedings 2005</i> , 141-145.		
10	RPM	PC	US	To determine the drivers and barriers for Remote Patient Management for chronic disease care.	1, 2, 3, 4, 6, 7	Drivers of and barriers to adoption: (1) integration of care, (2) coaching, (3) increase trust, (4) workforce changes, (5) productivity increase, (6) lack of experience, (7) lack of guidance and (8) financial consequences
				Coye, M.J., Haselkorn, A. & DeMello, S. (2009). Remote Patient Management: Technology-Enabled Innovation and Evolving Business Models for Chronic Disease Care. <i>Health Affairs</i> , 28(1), 126-35.		
11	EMR	PC	US	To define the barriers to the adoption of IT in small physician practices, with an example study on EMRs.	2, 4, 13	Barriers: (1) high costs, (2) attitude towards new IT compared to an old good functioning system, (3) uncertainty about vendor selection
				Davidson, E. & Heslinga, D. (2007). Bridging the IT Adoption Gap for Small Physician Practices: An Action Research Study on Electronic Health Records. <i>Information Systems Management</i> , 24(1), 15-28.		
12	EMR, EP	PC	VA	Obtaining perceptions on health IT with regard to quality of care and	1, 2, 5	The article mentions concerns about (1) efficient management, (2) increased quality of care, which caused (3) satisfaction and a positive attitude by

#	Innovation type	Research area/ scope	Country	Innovation & research purpose	CSF category	Critical success factors/ barriers
				satisfaction.		physicians.
				Davis, K., Doty, M.M., Shea, K. & Stremikis, K. (2009). Health Information Technology and Physician Perceptions of Quality of Care and Satisfaction. <i>Health Policy</i> , 90(2), 239-246.		
13	NS	PC	CA	Construction of a model that shows the potential of IT in order to encourage IT in primary care.	2, 3, 12	The validated model contains areas relating to the (1) attitude, (2) knowledge and (3) ease of use/control.
				Dixon, D.R. & Dixon, B.J. (1994). Adoption of Information Technology Enabled Innovations by Primary Care Physicians: Model and Questionnaire Development. <i>Proceedings of the Annual Symposium on Computer Application in Medical Care</i> , 631-635.		
14	EMR	PC	US	To perform a workflow analysis in primary care practices and reduce paperwork.	1	New strategies focusing on better workflow resulted in a significant result.
				Dykes, P.C., McGibbon, M., Judge, D., Li, Q. & Poon, E.G. (2005). Workflow Analysis in Primary Care: Implications for EHR Adoption. <i>AMIA Annual Symposium Proceedings</i> , 944.		
15	NS	GP	UK	To analyze the general practice characteristics that enable IT adoption.	2, 3	The article mainly describes characteristics in terms of demographic and education level, but also draws attention to barriers, namely (1) knowledge and (2) attitude.
				Evans, J.M.M., Guthrie, B., Pagliari, C., Greene, A., Morris, A.D, Cunningham, S. & Donnan, P.T. (2008). Do General Practice Characteristics Influence Uptake of an Information Technology (IT) Innovation in Primary Care? <i>Informatics In Primary Care</i> , 16(1), 3-8.		
16	VC	PC	FI	Study that compares traditional consultations and virtual (email) consultations in primary care.	1, 4, 5	Benefits: (1) more clinical effectiveness, (2) increased productivity and (3) cost reduction.
				Harno, K. Paavola, T. Carlson, C. & Viikinkoski, P. (2000). Patient Referral by Telemedicine: Effectiveness and Cost Analysis of an Intranet System. <i>Journal of Telemedicine and Telecare</i> , 6, 320-329.		
17	NS	PC	UK	A very old research on the positive and negative aspects of IT in primary care.	2, 3, 4, 12	Potential benefits: (1) improved patient care, (2) staff interaction on the system for improved information exchange and (3) good training enhances care quality. Potential obstacles: (1) insufficiency, (2) poor management, (3) physician resistance.
				Harvey, J.D. (1989). Towards a User-Friendly Future. The Impact of Information Technology within Primary Health Care. <i>International Journal of Technology Assessment in Health Care</i> , 5, 79-89.		
18	ER	GP	NO	Elaboration on the implementation and use of electronic referrals between primary care (general practice) and secondary care.	3, 6	Barriers: (1) knowledge gap (especially in secondary care), (2) the need for information exchange.
				Heimly, V. (2010). Electronic Referrals in the Health Sector in Norway, Challenges on the Road from Standard to High Volume Use. <i>International Symposium on Collaborative Technologies and Systems</i> , 643-646.		
19	ER	GP	VA	A general view on electronic referrals in health care at different countries, including key factors that must be taken into account in order to consider an implementation.	1, 10, 11, 12, 14	Problems that raised in the use of electronic referrals: (1) skepticism about replacing a good working referral system by new technology, (2) cultural issues per country, (3) legislation, (4) differences between health care systems, (5) disrupting a physician's daily working process and (6) political support.
				Heimly, V. (2009). Electronic Referrals in Healthcare: A Review. <i>Medical Informatics in a United and Healthy Europe</i> ,		

#	Innovation type	Research area/ scope	Country	Innovation & research purpose	CSF category	Critical success factors/ barriers
327-331.						
20	CDSS	GP	UK	Investigating the benefits of INRstar, a clinical decision support system on INR (international normalised ratio) blood tests in general practice.	2, 4, 5	Benefits: (1) improved anticoagulation control, (2) reduced number of INR tests required to maintain good control, (3) improved patient safety, (4) reduced potential for errors in dosing, (5) improved patient convenience and (6) contribution to practice financial income.
Jones, R.T., Sullivan, M. & Barrett, D. (2005). INRstar: Computerised Decision Support Software for Anticoagulation Management in Primary Care. <i>Informatics in Primary Care</i> , 13(3), 215-221.						
21	EMR	PC	US	The use of a survey tool to measure the effects of EMR use on user satisfaction, work efficiency and clinic processes at primary care practices	1, 3, 5	The survey outcomes imply that (1) "the majority of clinicians (strongly) agreed that the EMR resulted in efficiency gains", (2) online information adds value and (3) messaging improved the delivery of effective care
Joos, D., Chen, Q., Jirjis, J. & Johnson, K.B. (2006). An Electronic Medical Record in Primary Care: Impact on Satisfaction, Work Efficiency and Clinic Process. <i>AMIA Annual Symposium</i> , 394-398.						
22	NS	GP	UK	"To determine the prevalence of use of a range of ICT applications in general practice in London, UK."	2, 3, 15	Implementation barriers concern (1) time to implement, (2) lack of technical support, (3) finance, (4) lack of training, (5) attitude of colleagues towards an ICT innovation and (6) lack of awareness.
Keddie, Z. & Jones, R. (2005). Information Communications Technology in General Practice: Cross-sectional Survey in London. <i>Informatics in Primary care</i> , 13(2), 113-123.						
23	EMR	PC	US	A survey in primary care pediatric practices on EMR adoption barriers.	1, 2, 4, 5, 16	Barriers: (1) implementation & maintenance costs, (2) workload concern, (3) system downtime, (4) quality concern and (5) physician resistance
Kemper, A.R., Uren, R.L. & Clark, S.J. (2006). Adoption of Electronic Health Records in Primary Care Pediatric Practices. <i>Pediatrics</i> , 118(1), 20-24.						
24	NS	PC	US	"To determine whether electronic laboratory result viewing is associated with higher ambulatory care quality."	1, 2, 17	"Electronic access to laboratory results associates with (1) higher performance on preventive care [i.e. efficiently], (2) chronic disease management and (3) patient satisfaction."
Kern, L.M., Barrón, Y., Blair, A.J. Salkowe, J., Chambers, D., Callahan, M.A. & Kaushal, R. (2007). Electronic Result Viewing and Quality of Care in Small Group Practices. <i>Journal of General Internal Medicine</i> , 23(4), 405-410.						
25	OPP	PC	US	A research on the behavioral intentions with respect to the use of an online portal.	17, 18, 19	Enablers for the acceptance of online patient portals are (1) perceived usefulness for future use and (2) personal innovativeness and (3) ease of use.
Klein, R. (2007). An Empirical Examination of Patient-Physician Portal Acceptance. <i>European Journal of Information Systems</i> , 16, 751-760.						
26	VC	PC	US	"This study evaluates the use of a web messaging system by staff and patients of UC Davis community Primary Care Network (PCN) clinic."	1, 17, 19	Benefits are: (1) patient satisfaction, (2) ease of use, (3) productivity gains.
Liederman, E.M. & Morefield, C.S. (2003). Web Messaging: A New Tool for Patient-Physician Communication. <i>Journal of the American Medical Informatics Association</i> , 10, 260-270.						
27	EMR	PC	US	Determining the adoption barriers to health IT (i.e. EMRs) in primary care with an industry-level efficiency approach.	1, 5, 6, 19	The most mentioned adoption factors are: (1) communication with patients, (2) researching treatment options, (3) issuing reminders, and (4) sharing clinical information.

#	Innovation type	Research area/ scope	Country	Innovation & research purpose	CSF category	Critical success factors/ barriers
				Litwin, A.S. (2009). Why Don't Docs Digitize? The Adoption of Health Information Technology in Primary Care Medicine (Working Paper No. 1431202). Baltimore, MD: Johns Hopkins University. Retrieved March 5, 2011, from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1431202 .		
28	EMR	PC	VA	Elaboration on several papers concerning primary care IT innovations from a broad perspective, while comparing New Zealand and Denmark, but also considering the UK, the US and Canada	3, 4, 6, 7, 8	The article mentions important key factors, including (1) interoperability, (2) lack of capital, (3) committed leadership, (4) local champions, (5) adequate training and (6) structured record system.
				Lockhart, P. (2008). Two Nations Achieve a High Level of Primary Care Information Technology (IT) Interoperability: An Introduction To A Series Comparing Denmark and New Zealand's IT and Health Care. <i>Informatics in Primary Care</i> , 16(2), 179-181.		
29	NS	PC	UK	A preliminary research on IT integration and application in primary care.	2, 3, 5, 6, 7, 10	Before integration can take place, several issues must be resolved, namely (1) secure exchange of clinical data with respect to privacy concerns, (2) measurement tools regarding quality and provision, (3) standardization and protocols for data collection, (4) provision of value-adding services, e.g. training tools, (5) data integration to enhance information exchange.
				Lovell, N. H., & Celler, B. G. (1999). Information Technology in Primary Health-Care. <i>International Journal of Medical Informatics</i> , 55(1), 9-22.		
30	NS	GP	AU	A literature review on the drivers of ICT adoption in general practice and a research on the practice characteristics.	1, 4, 5, 6, 8, 9, 12	Drivers for ICT adoption are (1) pressure from patients, (2) pressure from medical suppliers, (3) pressure from competing GPs, (4) improved information storage and retrieval, (5) improved communication, (6) reduction of business costs, (7) improved business efficiency, (8) improved patient care/contact, (9) improved capacity to support systematic approach to disease management, (10) streamline billing and accounting, (11) strengthen relations with business partners, (12) facilitating e-commerce, (13) keep in touch with medical developments, (14) generate prescriptions and (15) keep in contact with hospitals.
				MacGregor, R.C., Hyland, P.N. & Harvie, C. (2009). Do Organisational Characteristics Explain the Differences between Drivers of ICT Adoption in Rural and Urban General Practices in Australia? <i>Australian Journal of Information Systems</i> , 16(1), 77-98.		
31	NS	PC	UK	Measuring the staff perceptions on IT adaption in primary care.	1, 2, 5, 8, 10, 14	Perceptions: (1) general belief in efficiency, communication, accessibility and accuracy improvements, (2) workload and work pattern concerns, (3) Confidentiality and security concerns, (4) political support or pressure, (5) enthusiasm towards technology.
				Mannan, R., Murphy, J. & Jones, M. (2006). Is Primary Care Ready to Embrace E-health? A Qualitative Study of Staff in a London Primary Care Trust. <i>Informatics in Primary Care</i> , 14, 121-131.		
32	EP	GP	AU	Measuring the use of GP's use of computers for prescribing and EMRs.	1, 5	Next to usage percentages, some suggested benefits gained by electronic prescribing involve (1) efficiency and (2) quality of care
				McInnes, D.K., Saltman, D.C. & Kidd, M.R. (2006). General Practitioners' Use of Computers for Prescribing and Electronic Health Records: Results from a National Survey. <i>Medical Journal of Australia</i> , 185(2), 88-91.		
33	EMR	PC	US	Researching the way in which IT and EMRs can improve medical professionalism and quality	3, 4	Mentioned barriers in the paper include (1) initial financial risk and (2) lack of IT skills/support

#	Innovation type	Research area/ scope	Country	Innovation & research purpose	CSF category	Critical success factors/ barriers
				of care.		
				Mechanic, D. (2008). Rethinking Medical Professionalism: The Role of Information Technology and Practice Innovations. <i>Milbank Quarterly</i> , 86(2), 327-358.		
34	EMR, EP	PC	US	Evaluating the shift towards medical homes for doctors in primary care.	1, 4, 5, 7, 17	Medical homes benefit from: (1) more collaboration between professionals causing better quality of care, (2) patient' and physicians' satisfaction, (3) reduce hospitalization (i.e. reduce costs) and (4) more coordinated proactive team approach (i.e. better regulation).
				Meyer, H. (2010). Group Health's Move To The Medical Home: For Doctors, It's Often A Hard Journey. <i>Health Affairs</i> , 29(5), 844-851.		
35	VC	PC	US	"To determine e-mail utilization patterns and attitudes toward e-mail use among primary care physicians and their ambulatory outpatient clinic patients."	1, 13	Major concerns are about (1) efficiency and effectiveness and (2) relationship with providers.
				Moyer, C.A., Stern, D.T., Dobias, K.S., Cox, D.T. & Katz, S.J. (2002). Bridging the Electronic Divide: Patient and Provider Perspectives on E-mail Communication in Primary Care. <i>American Journal of Managed Care</i> , 8(1), 427-433.		
36	NS	PC	NL	Evaluating 3 eHealth applications for supporting self-care at two periods: expectations beforehand and experiences subsequently.	3, 5, 10, 12, 19	Expectations: (1) support by application and (2) legal concerns. From the experiences, the following key elements are essential: (3) user-friendliness, (4) quality of care, (5) implementation of technology.
				Nijland, N., van Gemert-Pijnen, J., Boer, H., Stehouder, M. & Seydel, E.R. (2007). Evaluation of Internet-Based-Technology for Supporting Self-Care: Problems Encountered by Patients and Caregivers When Using Self-Care Applications. <i>Journal of Medical Internet Research</i> , 10(2), e13.		
37	VC	PC	US	An elaboration on the implications of innovating in primary care, which is necessary due to the ongoing staff reduction.	1	Key message is that the staff shortage causes the need for innovations in order to handle the demand. These innovations improve the efficiency, but also cause a higher workload
				Okie, S. (2008). Innovation in Primary Care - Staying One Step ahead of Burnout. <i>The New England Journal of Medicine</i> , 359, 2305-2309.		
38	EP	PC	US	Demographic research on the access and usage of electronic prescribing in US primary care.	3, 4, 11	Paper focuses on demographic differences, but also denominates the most important reason for adoption: (1) cost savings. Besides, other factors influencing adoption concern (2) socioeconomic conditions of the population and (3) availability of support.
				Pagán, J.A., Pratt, W.R. & Sun, J. (2008). Which Physicians Have Access to Electronic Prescribing and Which Ones End Up Using it? <i>Health Policy</i> , 89(3), 288-294.		
39	EMR, EP	GP	DK, NZ	A large research on differences in adoption of EMRs and electronic prescribing in general practice in Denmark and New Zealand.	1, 6, 9, 10, 15	CSFs applying to Denmark and also largely to New Zealand: (1) more timely communication with other clinicians, (2) time savings, (3) quicker receipt of results, (4) simplified repeat prescription, (5) improved patient management, (6) legibility of records and forms and (7) data for clinical research.
				Protti, D., Bowden, T. & Johansen, I. (2008). Adoption of Information Technology in Primary Care Physician Offices in New Zealand and Denmark, Part 3: Medical Record Environment Comparisons. <i>Informatics in Primary Care</i> , 16(4), 285-290.		
				Protti, D., Bowden, T. & Johansen, I. (2008). Adoption of Information Technology in Primary Care Physician Offices in New Zealand and Denmark, Part 4: Benefits Comparisons. <i>Informatics in Primary Care</i> , 16(4), 291-296.		

#	Innovation type	Research area/ scope	Country	Innovation & research purpose	CSF category	Critical success factors/ barriers
				Protti, D., Bowden, T. & Johansen, I. (2008). Adoption of Information Technology in Primary Care Physician Offices in New Zealand and Denmark, Part 5: Final Comparisons. <i>Informatics in Primary Care</i> , 17(1), 17-22.		
40	EMR	PC	US	Exploring different cases and determine the EMR adoption barriers.	4, 12, 13, 16	The cases, each characterized by a different discipline, practice size and location, have some key elements in common: (1) costs, (2) supplier presence, (3) trust (data control) and (4) customizability and reliability.
				Randaree, E. (2007). Exploring Physician Adoption of EMRs: A Multi-Case Analysis. <i>Journal of Medical Systems</i> , 31, 489-496.		
41	EMR	PC	US	Researching organizational characteristics that are associated with a high adoption rate in US primary care practices.	3, 4	Barriers derived from other literature: (1) up-front investment costs, (2) lack of support services and (3) lack of expertise.
				Reardon, J.L. & Davidson, E. (2007). An Organizational Learning Perspective on the Assimilation of Electronic Medical Records among Small Physician Practices. <i>European Journal of Information Systems</i> , 16, 681-694.		
42	EMR, VC, CDSS	GP	AU	"This study looked at the effect of information technology on rural medical practice."	3, 15, 16	Barriers indicated by GPs concern: (1) need for training and support, (2) lack of time, (3) reliability of technology and (4) disinterest with respect to IT as current methods still satisfy the needs.
				Robinson, A. (2003). Information Technology Creeps into Rural General Practice. <i>Australian Health Review</i> , 26(1), 131-137.		
43	NS	GP	UK	Examining the issues that GPs feel to be of major significance with respect to IT changes in their work.	1, 2, 4, 7, 15	Benefits of successful implementation: (1) improved information management, (2) improved quality of patient care, (3) efficiency gains in staff time, (4) improved information flow, (5) development of quality standards, i.e. clinical governance. An important implementation barrier is (6) skepticism about modernization (IT) initiatives.
				Rooney, I. & Hornby, S. (2000). Blackwell Science, Ltd From Troglodytes to Information Managers: Information Management and Technology Needs to Achieve the Primary Care NHS Modernization Agenda - The Views of Three GPs. <i>Health Libraries Review</i> , 17, 148-156.		
44	NS	GP	UK	"To investigate the current use, acceptance of, and the real potential of information technology in the 23 general practices in one primary care trust."	3, 10, 13	Key aspects from interviews with GPs: (1) lack of technical support, (2) security and confidentiality issues and (3) IT service provider issues in larger practices.
				Roycroft, R. (2004). Does IT 'Cut the Mustard' in Primary Care? <i>Informatics in Primary Care</i> , 12(2), 97-102.		
45	EMR	PC	CY	Researching the problems and issues that occur during the implementation of EMRs in Cyprus.	1, 3, 10, 16, 20	Major impediments: (1) workflow affection, (2) legal concerns, (3) lack of incentives, (4) system breakdowns and (5) inadequate technical support.
				Samoutis, G., Soteriades, E.S., Kounalakis, D.K., Zachariadou, T., Philalithis, A. & Lionis, C. (2007). Implementation of an Electronic Medical Record System in Previously Computer-Naïve Primary Care Centres: a Pilot Study from Cyprus. <i>Informatics in Primary Care</i> , 15(1), 207-216.		
46	EMR	GP	UK	Elaboration on the impact of electronic prescribing in general practice, based on interviews	1, 3, 4, 10, 16	Key benefits: (1) improved practice operations, (2) better documentation of chronic care, (3) elimination of down time, (4) quality of care improvement, (5) record legibility.
				Schade, C.P., Sullivan, F.M., De Lusignan, S. & Madeley, J. (2006). e-Prescribing, Efficiency, Quality: Lessons from the Computerization of UK Family Practice. <i>Journal of the American Medical Informatics Association</i> , 13(5), 470-475.		
47	CDSS	PC	US	Investigating the adoption barriers to decision support for chronic care by	5, 7, 20	Adoption key aspects: (1) external incentives, (2) guidelines and (3) quality of care improvement

#	Innovation type	Research area/ scope	Country	Innovation & research purpose	CSF category	Critical success factors/ barriers
				physician organizations.		
				Simon, J.S., Rundall, T.G. & Shortell, S.M. (2006). Adoption of Order Entry with Decision Support for Chronic Care by Physician Organizations. <i>Journal of the American Medical Informatics Association</i> , 14(4), 432-439.		
48	EMR	PC	US	"A one-page survey measured use of health information technology, plans for EHR adoption and perceived barriers to adoption."	1, 3, 4, 13	Implementation barriers: (1) Lack of adequate funding, (2) can't find EMR that fits the needs, (3) lack of technical knowledge or support, (4) no physician support for change and (5) would interfere too much with workflow.
				Simon, S.R., McCarthy, M.L., Kaushal, R., Jenter, C.A., Volk, L.A., Poon, E.G., . . . Bates, D.W. (2005). Electronic Health Records: Which Practices Have Them and How are Clinicians using them? <i>Journal of Evaluation in Clinical Practice</i> , 14, 43-47.		
49	EP	PC	SI	Evaluation of electronic prescription systems in primary care in Singapore, based on a survey.	1, 5, 17	Findings: (1) Reduction of prescribing errors, (2) workflow interference, (3) general user satisfaction.
				Tan, W.S., Phang, J.S.K, Tan, L.K. (2009). Evaluating User Satisfaction with an Electronic Prescription System in a Primary Care Group. <i>ANNALS Academy of Medicine Singapore</i> , 38, 494-500.		
50	EMR	PC	CA	Determining the key implementation factors of EMRs in primary care.	2, 3, 13, 15, 21	Main findings concern (1) expectations of EMRs, i.e. attitude, (2) training issues, (3) time concerns, (4) presence of an IT project leader is critical, (5) provider's readiness to accept EMRs.
				Terry, A., Thorpe, C.F., Gilles, G., Brown, J.B., Harris, S.B., Graham, J.R., . . . Stewart, M. (2008). <i>Canadian Family Physician</i> , 54(5), 730-736.		
51	CDSS	PC	US	Evaluating development and implementation barriers of computerized clinical guidelines.	1, 2, 3, 19, 22	Listed success factors are: (1) physician perception of usefulness of computers, (2) physician knowledge, (3) ease of use, (4) integration of software in the work setting, (5) training in program use, (6) clinician involvement in development and implementation, (7) technical issues and support.
				Trivedi, M.H., Kern, J.K., Marcee, A., Grannemann, B., Kleiber, B., Bettinger, T., . . . McClelland, A. (2002). Development and Implementation of Computerized Clinical Guidelines: Barriers and Solutions. <i>Methods of Information in Medicine</i> , 41(5), 435-442.		
52	NS	GP	UK	Applying and evaluating a diffusion of innovation framework in general practice.	1, 3, 14	Main findings: (1) lack of training and resource, (2) workload issues and (3) political support
				Wainwright, D.W. & Waring, T.S. (2007). The Application and Adaptation of a Diffusion of Innovation Framework for Information Systems Research in NHS General Medical Practice. <i>Journal of Information Technology</i> , 22, 44-58.		
53	NS	GP	UK	Researching the influence of politics on IT adoption and diffusion in general practice	14	The article is mainly about the innovation and technology driven agenda of politics on primary care.
				Wainwright, D.W. & Waring, T.S. (2006). The Politics of Information and Communication Technology Diffusion: A Case Study in a UK Primary Health Care Trust. In B. Donnellan, T. Larsen, L. Levine, J. DeGross (Eds.), <i>The Transfer and Diffusion of Information Technology for Organizational Resilience</i> (pp. 71-90). Boston, MA: Springer.		
54	VC	PC	US	An early study on the adoption of telemedicine for patients suffering from a sickle cell disease in Georgia, a very large US state.	3, 23	Issues regarding a remote-site telemedicine room: (1) training is necessary, (2) reduced travelling time
				Woods, K. Kutlar, A., Grigsby, R.K., Adams, L., Stachura, M.E. (1999). <i>Telemedicine Journal</i> , 4(4), 353-361.		

#	Innovation type	Research area/ scope	Country	Innovation & research purpose	CSF category	Critical success factors/ barriers
55	NS	PC	US	A general approach on the factors that determine technology acceptance by doctors, building on previous researches on TA.	1, 12, 15, 17	<p>“Based on extant research on barriers to physician technology acceptance, it can be concluded that (1) time/practice-related issues, (2) organizational issues (e.g. changing workflow), (3) personal issues (e.g. satisfaction), and (4) system-specific characteristics (e.g. type of technology used) influence a physician’s acceptance of a new technology.”</p> <p>Yarbrough, A.K. & Smith, T.B. (2007). Technology Acceptance among Physicians: A New Take on TAM. <i>Medical Care Research and Review</i>, 64, 650-672.</p>
56	VC	PC	MA	Evaluating teleconsultation in Malaysia and finding the benefits.	1, 4, 23	<p>Benefits: (1) enhancing patient access, (2) effective treatment and (3) efficiency increase.</p> <p>Yusof, K., Neoh, K.H.B. (2002). Role of Teleconsultation in Moving the Healthcare System Forward. <i>Asia-Pacific Journal of Public Health</i>, 14(1), 29-34.</p>

Table 13 – Extensive overview of source extraction after selection procedure.

Appendix B

FRAMEWORK A: guidelines

PHASE 1: Planning & analysis

During the planning phase, most time is spent on high level preparatory work and the determination of general goals. A further elaboration of these goals and the determination of end-user needs are typical activities that take place through the analysis stage. Besides, some side issues play a key role as well, such as budgeting which is usually imposed by an external financier (e.g. governmental allowance). The roles of the CSFs in this stage described in Table 14.

PLANNING & ANALYSIS	
Critical Success Factor	Description
Finance	Make sure there is money available for the design and implementation, but also for the maintenance of the innovation. Also, calculate the possible savings that the innovation can effectuate. Currently, many IT innovations are subsidized or in some way stimulated by the Dutch government, which captures the finance barrier to some extent.
Legislation, security & privacy	Privacy concerns should be taken very seriously, especially in case of an IT innovation with central data storage and information exchange over the internet. Online account systems must be well-protected by advanced security and privacy systems (e.g. considering the implementation of the national DiGiD system). Also, legislation must be checked with respect to data storage and sharing in order to approve the IT innovation legally.
Attitude towards IT	Especially the older practitioners (> 50) expect and/or experience more snags with the use of new technologies. It is important to create awareness among professionals regarding the benefits of IT deployment. The younger practitioners have a more enthusiastic attitude towards IT innovations, hence less problems are expected from them.
Political Support	Political support can be decisive in the adoption of new IT into a general practice. Although poor political support is a serious barrier, individual practices have usually no direct influence on them.
Vendor & provider	Vendor selection is only relevant when there are more vendors to select from. In many cases, IT innovations are unique and

	<p>therefore only one vendor is the provider. Also, other innovations such as a national EMR that is centrally managed by the government causes the imposition of a choice.</p>
<p>Sociability & culture</p>	<p>Socio-economic differences are not a major problem in The Netherlands. Every Dutchman has the possibility to access the internet against affordable rates, so if the IT innovation involves the necessity of internet at the patient side (e.g. in case of an online portal), no problems should be expected. However, 8 percent of the Dutch population has never used internet and 9 percent does not have an internet connection at home (Europese Commissie, 2011). In order to not exclude people from health care services, the IT innovation to be implemented should only have essential functionality if there are offline alternatives as well.</p>
<p>Incentives</p>	<p>The IT innovation can be thoroughly, but it is important to have a good initial analysis of the current situation and the benefits of the IT innovation, especially if it replaces an existing system. Many practitioners just got used to the previous system and don't want to migrate since the current system meets the conditions. In other words, professionals should see the point of the IT innovation in order to get convinced.</p>
<p>Presence of IT manager</p>	<p>Depending on the size and complexity of the innovation, the appointment of an IT manager should be considered. A temporary appointment of such an IT manager is essential during the design and implementation stage of a large innovation project as practitioners do not have time and the knowledge to implement a new IT innovation in their practice. For smaller innovation projects, only technical staff should be hired for the implementation stage and documentation/support could be delivered afterwards.</p>
<p>Perceived forecasted value</p>	<p>Compared to the incentives factor, this one has a stronger focus on desired future improvements rather than fear for change. The IT innovation should have a clear purpose, e.g. make work easier or faster. If practitioners do not have a good view on the advantages of the new system, they are not willing to deal with it.</p>
<p>Available implementation time</p>	<p>Primary care practitioners have busy daily schedules and therefore no time to upset all current systems in order to implement a new one. In case of a new IT innovation that needs to be implemented locally, the practitioner should be able to perform his/her tasks without troubles. For instance, vital</p>

Competition	applications such as patient files should always remain accessible.
	Competition between practitioners is not very present , as patients can only choose between a few practices based on their location. General practices collaborate rather than compete within districts. Besides, patients do not continuously change between doctors, which makes competition impact almost non-existent.

Table 14 – CSFs during the planning & analysis stages.

PHASE 2: Design & implementation

The implementation & design stages contain the development steps of the IT innovation. The design consists of the architectonic software solution and the realization of the technical specification is conducted during the implementation stage. See Table 15.

DESIGN & IMPLEMENTATION	
Critical Success Factor	Guideline
Guidelines & standardization	Practitioners are not always convinced about the deployment of proper technology as well as adherence to protocols. Using existing standards helps to satisfy health professionals, and it enables an eventual future system integration
System reliability	Although reliability of the system is an issue, practitioners do not have many influence on the technical robustness of the system. The problem of many IT innovations is that they lack in maturity, so the implementing organization must provide some warranties for reliability, e.g. based on certificates or multiple environment testing.
Ease of use	The usability of the innovation in daily practice must be ensured. Although the effect of this factor can only be measured afterwards (i.e. while evaluating user satisfaction), it is crucial to draw serious attention to this during the design stage.
User involvement	Involving end-users during the design and implementation is very important in order to discover design flaws and aspects that dissatisfy the users. In case an innovation is used by GP and patient, a representation of both groups must be involved for testing and providing feedback.

Table 15 – CSFs during the design & implementation stages.

PHASE 3: Use & maintenance

After the development stage, the IT innovation is ready to use. Next to the deployment, imperfections to the system could be discovered and follow-up services such as training and support are conducted. See Table 16.

USE & MAINTENANCE	
Critical Success Factor	Guideline
Workflow, productivity & efficiency	Although innovations are usually designed to improve productivity, under some circumstances this rule does not apply. If a system has the purpose to improve the quality of care, it should not be at the expense of productivity and efficiency. For example, e-prescription tools that are more time consuming than before, are badly designed. IT should always speed up tasks instead of holding up. Preliminary measures of the time consumption can clarify the consequences for efficiency and productivity.
Care quality	The IT innovation should not only focus on making tasks easier or faster, but they should also focus on care quality. If the IT innovation decelerates daily work, it negatively affects the quality of care. Fortunately, most IT innovations are designed to improve care quality, e.g. CDSs for consistent decision making.
Knowledge, skill & support	It is important to train the practitioner in using the innovation. Many systems are not self-explanatory and need extended documentation and training. Besides, the innovation partner (i.e. vendor) should provide online support in case of troubles.
Technology & control	The IT innovation should not take too many decisions by itself, i.e. there must be room left for interruption by the practitioner. Especially in the case of a decision support system, this factor should be taken into account.
Interoperability	Practitioners appreciate it when a new system is able to exchange its information with other systems that the practitioner already uses.
Communication	In addition to the workflow aspect, the time consumption caused by the innovation may not lead to less communication with the patient.
Patient access & traveling	If the innovation involves a time saving functionality because of remote access (e.g. in case of virtual communication) traveling distances can be avoided. This factor is not of great influence in The Netherlands as the distance between the practice and

User satisfaction

patient is usually very low.

The IT innovation will only be a success when the user can successfully fulfill his task without getting annoyed or bothered by wrong design elements. This factor was also discovered by DeLone & McLean (2003).

Table 16 – CSFs during the use & maintenance stage.

Appendix C

Semi-gestructureerd Onderzoeksinterview t.a.v. modelverbetering (Expert interviews in Dutch)

1. Bij welk type innovaties bent u betrokken geweest?
 - a. EPD
 - i. Elektronisch recepten voorschrijven
 - ii. Elektronisch doorverwijzen
 - b. Virtuele communicatie
 - c. Online portalsysteem
 - d. CDSS
2. Hoe wordt tijdens het innoveren bijgehouden hoe het project verloopt? Worden zulke projecten systematisch gemonitord?
3. Wat is de beste manier om succes te **meten** van IT innovatieprojecten in de eerstelijns?
4. Wie zijn de belangrijkste partijen ('rollen') wanneer u gaat innoveren met IT-producten in de eerstelijns? Bij welke 'rol' zitten in principe de meeste knelpunten?
5. Met betrekking tot het meten/bepalen van het succes, welke verschillen bestaan er tussen het uitvoeren van een proef (**pilot**) project en een volledig werkende implementatie die uit de proeffase (**non-pilot**) is?
6. In de IT-wereld worden over het algemeen 6 ases onderscheiden van innoveren in IT systemen, te weten **Planning, Analyse, Ontwerp, Implementatie** en **Gebruik/onderhoud**. Welke zijn hiervan van belang voor de innovaties waar u mee hebt gewerkt, vanuit uw professie (rol)? Kunt u ze op volgorde zetten van belangrijkheid?
7. Kunt u (de) vijf belangrijkste punten (succesfactoren) noemen die van belang zijn bij het plannen, analyseren, ontwerpen, ontwikkelen, implementeren en gebruiken van een IT innovatie in de eerstelijnszorg? Kunt u de 10 volgens u belangrijkste factoren in volgorde zetten van belangrijk naar minst belangrijk (met een nummer)?
 - a. Welke factoren zijn specifiek relevant voor Nederland t.o.v. buitenland?
8. Uit mijn theoretisch kader, dat internationaal en algemeen op de eerstelijnszorg gefocust is, kwamen de volgende resultaten (volgende pagina). Kunt u per factor aangeven in welke mate u ze herkent en relevant vindt, gebaseerd op uw eigen ervaringen met dergelijke innovaties?
9. Welke succesfactoren/knelpunten kunnen tijdens het proces nog goed worden bijgestuurd en welke nauwelijks/niet? (met een pijltje →)
10. De frequenties van de succesfactoren geven het volgende plaatje (volgende pagina). In welke mate vindt u de resultaten logisch, dan wel verrassend te noemen? Kunt u zich er goed in vinden?
11. Zijn er nog aspecten in het onderzoek waarover u zich hebt verbaasd, danwel niet aan bod zijn gekomen en dus missen aan het onderzoek?

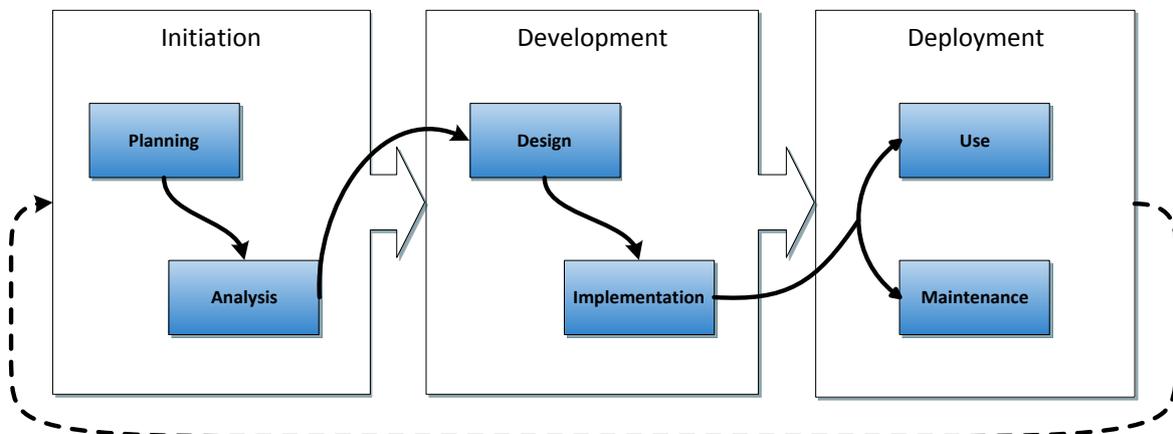
#	CSF or barrier	Description	Rate
	Workflow, productivity & efficiency impact	Every aspect that influences the daily workflow i.e. time saving or time-consuming activities caused by the implementation or use of an innovation.	
	Attitude towards IT	Bias of involved people (i.e. patient or doctor) with regard to implementing an IT solution.	
	Knowledge, skill & support barrier	Concerns about the lack of (technical) support or in-house knowledge to use an IT innovation in practice.	
	Financial impact	High investment costs and uncertainty about the return on investment.	
	Quality concern	The influence of the IT innovation on the quality of care. It is reported either as an improvement [success] or deterioration [barrier] in quality.	
	Interoperability	The extent to which information between systems is or can be exchanged.	
	Guidelines & standardization	Concerns about the guidelines, standards and other regulation aspects that comes along with innovation.	
	Competition impact	The competitive advantage that can be gained by the implementation of a new innovation.	
	Communication impact	The positive or negative influence of changes in communication.	
	Legal, security & privacy concern	Factor about any kind of legal, security and privacy issues, caused by concerns and resulted by implementing new IT.	
	Social & cultural impact	Influence on doctor-patient relationship as well as social economic factors.	
	Technological impact & control	Difficulties in learning and choosing new technologies, as well as fear to lose control due to technology intervention.	
	Vendor & provider issues	Concerns about vendor selection and maintaining the provider relationship.	
	Political support	The extent to which IT innovations are supported by governmental and local authorities.	
	Time concern	Lack of implementation time [barrier], but also the time savings gained by the innovation [success].	
	System reliability	Concerns about the reliability and dependability of IT systems.	
	User satisfaction	The extent to which the innovation satisfies the user while using the system.	
	Perceived forecasted value	Perceived usefulness of the innovation for future use.	
	Ease of use	User-friendliness and accessibility issues of the IT product/service.	
	Incentives concern	Lack of motivation, i.e. "why change if everything works fine?"	

Presence of IT manager	The presence of an IT manager to direct and lead the employees (i.e. primary care practitioners) .
Physician involvement in development and/or implementation	The extent to which the primary care practitioner participates in the development process of the IT innovation.
Patient access and/or traveling impact	The improvement of access and distance decrease as result of IT utilization, which is especially relevant in case of virtual consultation if the patient is a bad walker or must travel a great distance for primary care.

Appendix D

Semi-gestructureerd Onderzoeksinterview t.a.v. modelverbetering (Senior expert interview in Dutch)

1. Bij welk type innovaties bent u betrokken geweest?
 - a. EPD
 - i. Elektronisch recepten voorschrijven
 - ii. Elektronisch doorverwijzen
 - b. Virtuele communicatie
 - c. Online portalsysteem
 - d. CDSS
2. Wat kunt u vertellen over het **meten van succes** in IT innovatieprojecten in de eerstelijns?
3. In de IT-wereld worden over het algemeen 6 fases onderscheiden van innoveren in IT systemen, te weten **Planning, Analyse, Ontwerp, Implementatie** en **Gebruik/onderhoud**. Welke zijn hiervan van belang voor de innovaties waar u mee hebt gewerkt, vanuit uw professie (rol)? Kunt u ze op volgorde zetten van belangrijkheid?



4. Uit mijn theoretisch kader en praktijkstudie kwamen de volgende resultaten (volgende pagina e.v.). In welke mate kunt u zich vinden in de scores die de ervaringsdeskundigen hebben gegeven aan de succesfactoren?

Vragen framework

5. Het framework bevat 3 grote rollen: **innovator, GP en patient**. Vind u dit een **compleet beeld** geven van innoveren in de eerstelijnszorg m.b.t. actoren?

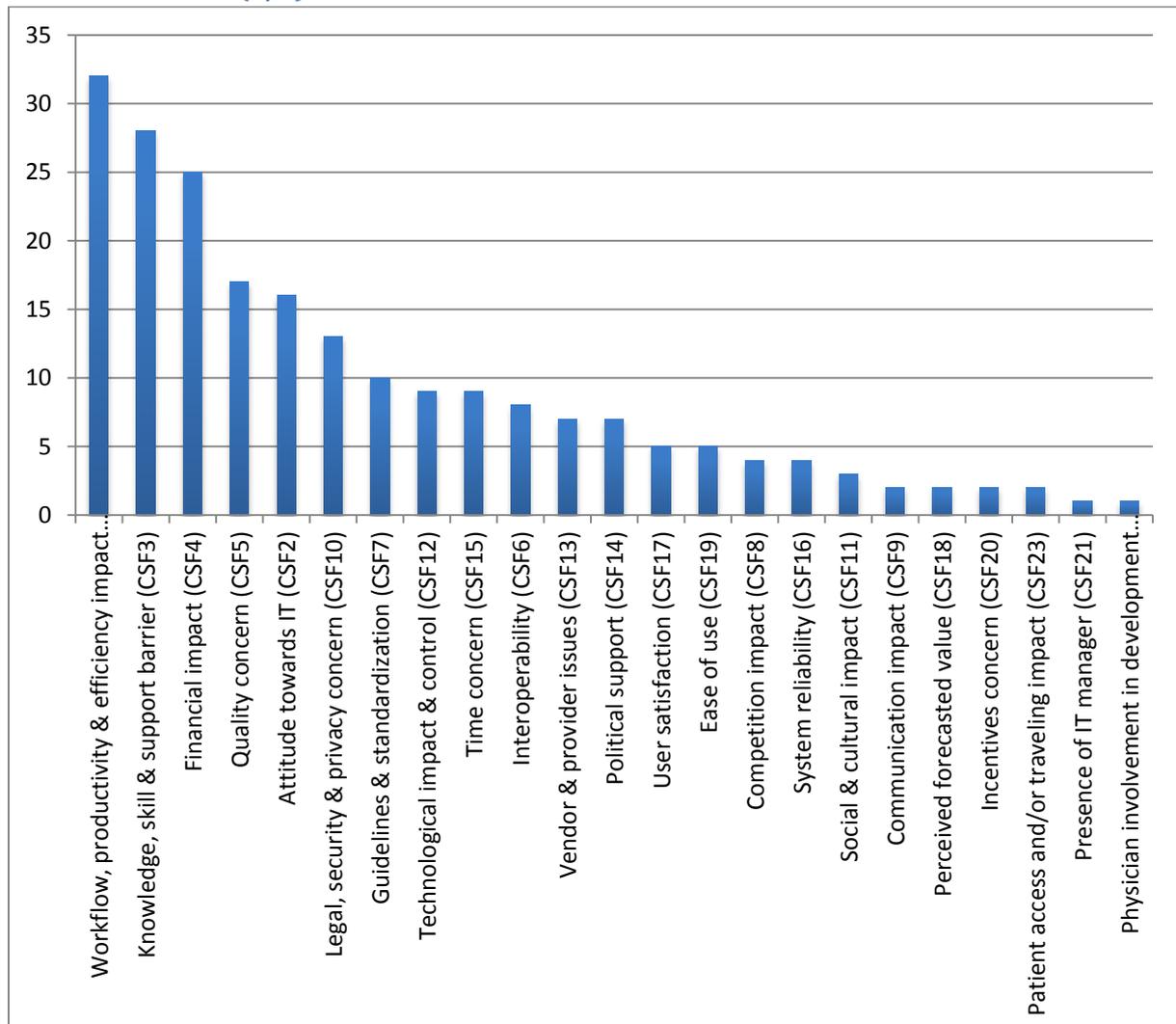
6. Vind u het een logische keuze om het model te **centreren rondom deze 3 actoren**, of zou u een andere indeling prefereren (bijv. per innovatiefase)?
7. In welke mate zijn de **externe actoren** (linksboven) van belang bij het proces? Zijn ze overbodig, dan wel onderbelicht?
8. Het model bevat een boog, die **6 veronderstellingen** (basic assumptions) belichaamt waar innovaties sowieso aan moeten voldoen. Vind u de keuzes hiervoor logisch? (1 voor 1 aflopen)
9. In welke mate vind u de **succesfactoren** die in het model staan representatief? (1 voor 1 aflopen)
10. Overall, vind u het model een **goede representatie** geven van innoveren in de eerstelijnszorg?
11. Wat mist u in het model? Zijn er aspecten die niet in de literatuur en praktijk direct naar voren kwamen, maar toch van groot belang zijn om in het model op te nemen?

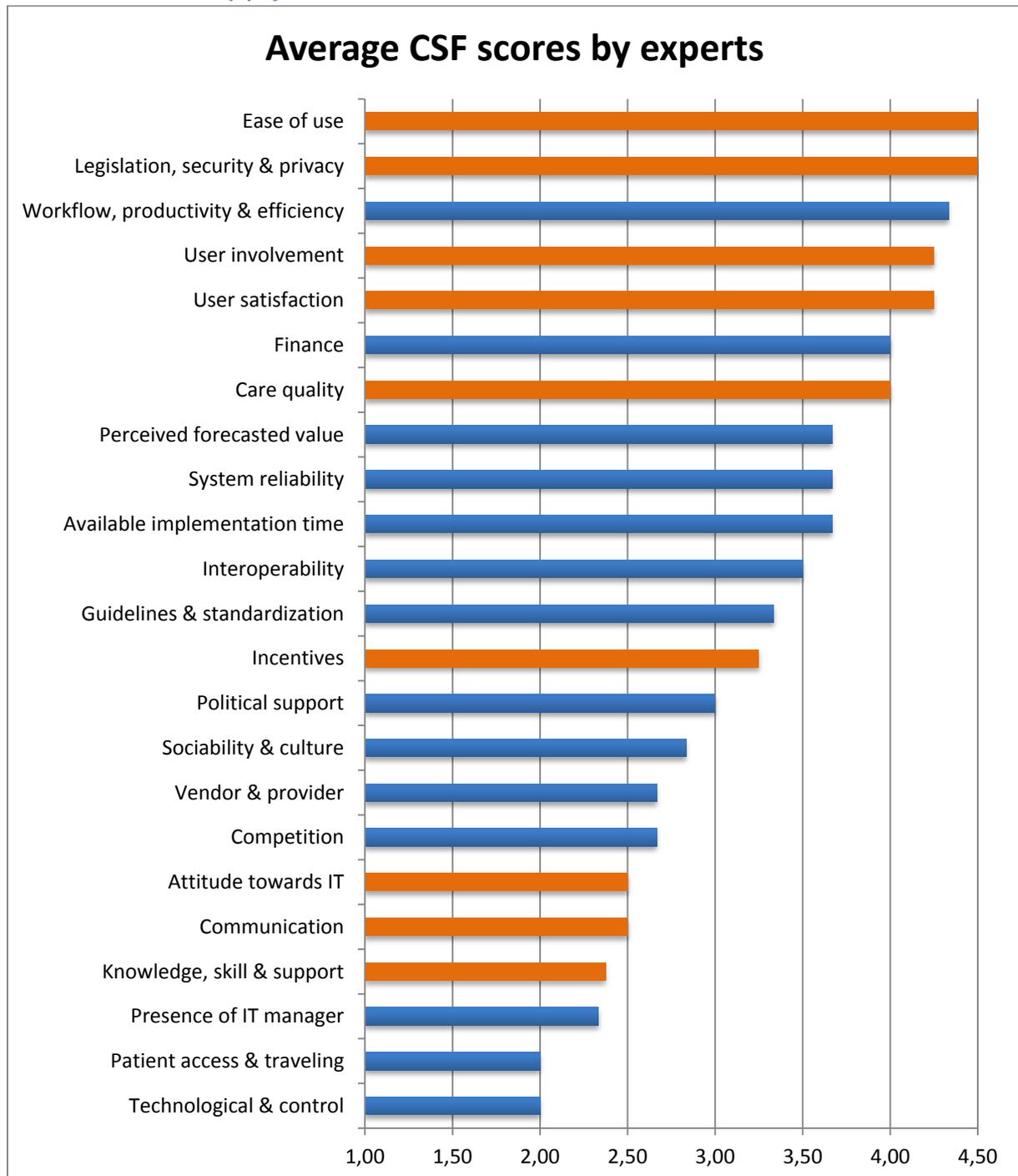
THEORY RESULTS (1/2)

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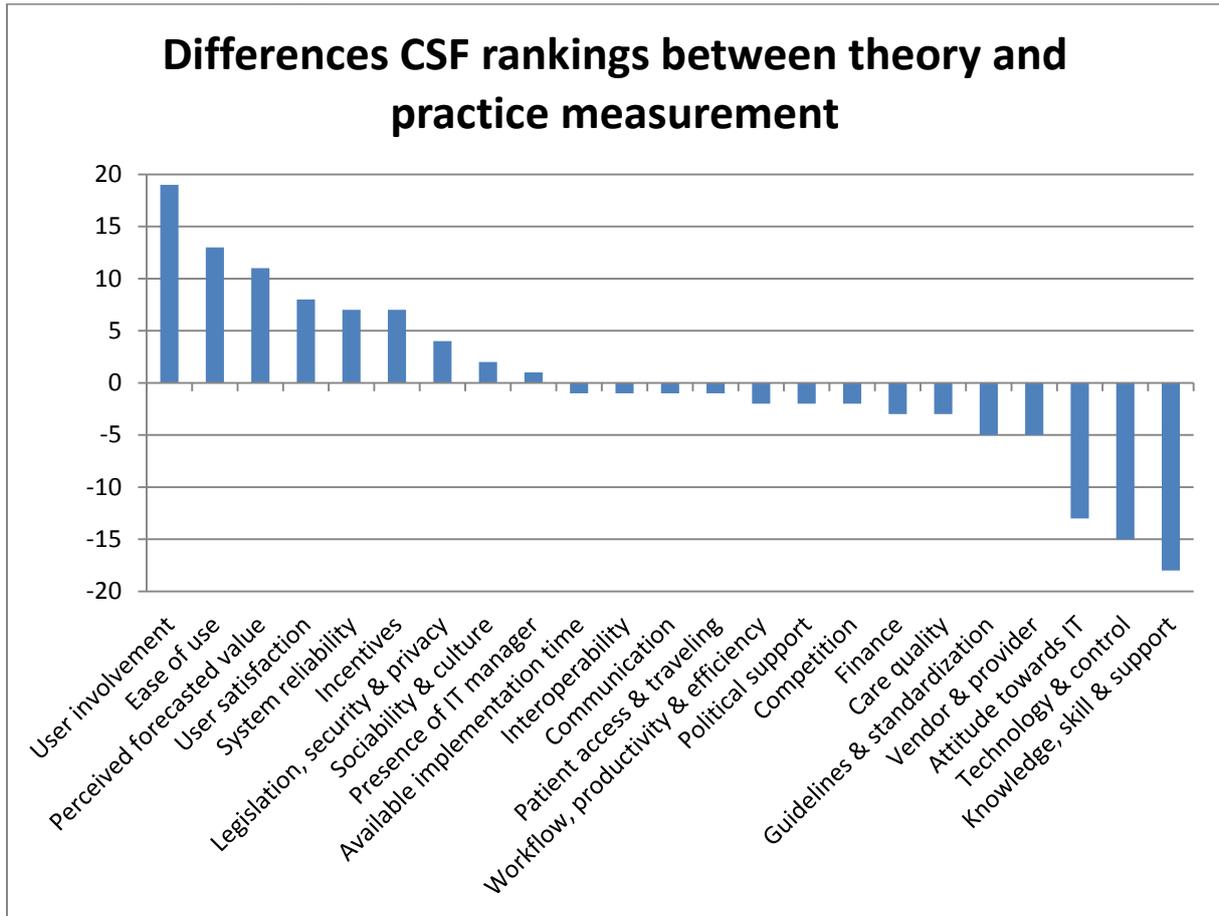
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THEORY RESULTS (2/2)



PRACTICE RESULTS (1/3)

PRACTICE RESULTS (2/3)



FRAMEWORK

