The start of IT Governance in a Dutch Academic Medical Centre

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Master Thesis Business and IT
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Summary

The most commonly accepted definition of IT governance is: "*IT Governance represents the framework for decision rights and accountabilities to encourage desirable behaviour of IT".* In the industrial domain it is widely accepted that IT Governance directly influences the benefits generated by organisational IT investment, in healthcare this is not the case.

Specific challenges to the healthcare domain arise due to the diversified organisational structures and the autonomy of the healthcare professionals. Top down implementation is impossible and with the autonomy of the healthcare professional at risk, stakeholder management is extremely important in the healthcare domain.

A 'big bang' approach would not work in the Radboudumc. Since everyone and everything has to earn its place it is important to prove something before implementing everything and thereby changing everything. IT governance could be started in a small area. Information security is well-suited, as the Radboudumc is to some extent familiar with the ISO 27001 standard.

Furthermore, one of the major aspects in terms of support for IT Governance and the IT Governance framework is how well it is known. ISO 27001 has gained a lot of publicity during the last years. Documentaries, news items and newspapers have written about information security, and the lack thereof, in hospitals multiple times during 2016. Furthermore, ISO 27001 can aid research at the Radboudumc directly. More often than not subsidies (grants) for research contain a specific criterion that states that the academic medical centre (or other body conducting the research) has to be ISO 27001 certified, to ensure information security is up to standard.

Another advantage of starting small is the opportunity to measure success on these subjects and showcase these successes to increase support for IT Governance.

The following three principles should be leading for the Radboudumc:

- *Our employees work autonomously*.
  Making sure that the autonomous professionals at the Radboudumc are not hindered but rather supported is key if we want IT Governance to be successful at the Radboudumc.
- *Measure twice, cut once.*
  Since one has to earn its place in the Radboudumc and recognising and accepting authority of governance bodies is not a given at the Radboudumc doing the right things and measuring success is vital.
- *Communication is everything*.
  Communication among stakeholders to make sure the correct people are seated at the IT Governance table. And the communication of IT Governance initiatives and successes.

Due to the nature of the Radboudumc and the extreme importance of stakeholder management we recommend the following implementation sequence of IT Governance:

- chapter 6 of ISO 27001; organisation of information security

- implementing chapters 5 until 15 of ISO 27001 and evaluate what has been achieved after twelve months.

Acknowledgements

This thesis marks the end of my seen years as a student. It took six months to write, ten if you include the course 'Research Topics'. Looking back, it was a relatively smooth ride. Not as smooth as expected, with new challenges around every corner, but sticking to a tight schedule helped me finish the project in time.

Sticking to this tight schedule and being able to cope with the challenges that arose is primarily thanks to my supervisors at the University of Twente, Klaas Sikkel and Lucas Meertens.

I am glad that Klaas and Lucas agreed to be my supervisors even though they both felt they were not experts in IT governance, let alone in healthcare. I have heard from many of my fellow graduates that having the right supervisors, that are willing to regularly go through your work both on high level and in detail is a major influencer of the success of the thesis. Thank you Klaas and Lucas for supporting me during the last ten months of my study.

I also want to take the opportunity to thank Ronald Kerremans, my supervisor at the Radboudumc. Even though circumstances made him carry the load of two full time jobs, he inquired about my thesis multiple times during the last six months. Ronald, thank you for leaving me a lot of room to figure out where to go and whom to meet and provide professional input in a field where business sets the rules (instead of theoretic academics!).

I wrote this thesis as a Compliance & Security Officer at the Radboudumc and I am grateful for this opportunity. I thoroughly believe that being able to gain hands on experience during this period has helped me transition theory into practice and exactly this knowledge helped me put IT governance into practice. I could not have wished for colleagues that are more passionate about what they do, and how they, all in their own way, help the Radboudumc to deliver the best healthcare, education and research.

Finally, I would like to thank my friends and family, especially my father and my girlfriend. They have supported me along every step of this project and have read my thesis more times than I can count. It helped that my father is an IT professional himself and could relate to the matter presented in this thesis, my girlfriend on the other hand is very precise and guided me through the process of referencing APA style correctly (which is a very tedious practice at the least).

Gideon Teerenstra
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1. Introduction

In the industrial domain it is widely accepted that IT governance (ITG) directly influences the benefits generated by organisational IT investment (Lutchen & Collins, 2005; Weill, 2004). The most commonly accepted definition of IT governance is: "*IT Governance represents the framework for decision rights and accountabilities to encourage desirable behaviour of IT*" (Weill, 2004). Weill extends this definition by providing a contrast to IT management: "*IT Governance is not about what specific decisions are made. That is management. Rather, governance is about systematically determining who makes each type of decision (a decision right), who has input to the decision (an input right), and how these people (or groups) are held accountable for their role.*" It is not surprising then that ITG, in businesses, has emerged as an important area of enquiry of academics and practitioners alike.

A working paper for the study of Business & IT shows that in healthcare this is not the case (Teerenstra, 2016). This working paper can be found in appendix D. Most healthcare organisations in the Netherlands are not-for-profit organisations and have a professional organisational structure (Eeckloo, Delesie, & Vleugels, 2007). These characteristics demand IT governance that differs from organisations in other domains, for example for-profit organisations with a diversified structure (Weill, 2004). The (Dutch) healthcare domain is a sensible domain for ITG, even though it is largely underinvestigated (Teerenstra, 2016). For example, the recent implementations of electronic patient records put higher demands on IT in the healthcare domain. This requires organisations to share information with external sources, which in turn requires that the healthcare organisations have organised their information processes in such an orderly fashion that they possess the ability to export information outside of the organisation (10, Haux, Ammenwerth, Brigl, Hellrung & Jahn, 2010). Specific challenges to the healthcare domain arise due to the diversified organisational structures and the autonomy of the healthcare professionals. According to one of the interviewees at the Radboudumc this makes top down implementation of ITG impossible.

The Radboudumc is a large university medical centre located in Nijmegen, the Netherlands. It consists of 52 financially independent departments. The three core activities of the Radboudumc are patient care, research and education. To support these three core activities, the IT department of the Radboudumc aims to develop novel IT artefacts that enable the hospital to deliver better healthcare, conduct better research and improve education. To improve their support to the three core activities they are considering the adoption of IT governance (ITG). This thesis looks at the concept of ITG, and how the Radboudumc should act on it.

2. Background

This section presents high-level background information to familiarise the reader with the subject matter and provide a line of reasoning towards the choice of the problem that is made explicit in the final section of this chapter.

ITG in healthcare organisations brings new challenges based on the nature of these organisations.

The organisations addressed in this study are Dutch hospitals, specifically academic medical centres. Academic medical centres are hospitals where all medical faculties can perform all possible treatments during the whole day (day and night) and are affiliated to a university for educational purposes (Centraal Bureau voor de Statistiek, 2012). One of these challenges is that the healthcare domain is unique in that it consists of professional bureaucracies (Mintzberg, 1989). The organisation requires highly trained specialists in its operating core, and gives them considerable autonomy in their work. Much of the necessary coordination is achieved by design, by the standard skills that predetermine behaviour. Not only do the specialists control their own work, but they also tend to maintain collective control over the administrative apparatus of the organisation. At the administrative level, however, in contrast with the operating level, tasks require a good deal of mutual adjustment, achieved in large part through standing committees, task forces and other liaison devices.

Being a public sector the healthcare domain is subject to high political pressures to redesign. Current pressures for example aim to redesign the healthcare sector to be more sustainable for future generations (Schippers & van Rijn, 2014).

A structured literature review showed that current research into the benefits of ITG in the healthcare domain specifically is not adequate in the sense that healthcare specific interventions and benefits are absent (Teerenstra, 2016).

In the private sector, frameworks exist to provide organisations with a structured approach to the implementation of ITG. Such a framework functions to show the organisation's desired state of ITG and which steps the organisation has to take to get there.

2.1 Problem statement

According to an initial literature search, reading of general publications and discussions with experts at the Radboudumc, no existing frameworks as described in the previous paragraphs currently cover ITG in healthcare.

In the Radboudumc specifically, the IT department wants to be able to make the right investment decision, develop the right IT artefacts and encourage not only the right behaviour of IT but also the business and IT alignment. Krey (2015) found that ITG can help by reducing the complexity of the medical profession by providing the right information promptly and ITG can align Business and IT, prioritise IT investments, deploy IT, sustain strategic and tactical direction and sustain the value proposition of IT (Krey, Furnell, Harriehausen, & Knoll, 2012).

Many ITG frameworks exist but it is not clear which one suits the healthcare specific situation best. At the same time, it is unclear whether these ITG frameworks work well in all healthcare specific situations or only a limited few. Last but not least, the available ITG frameworks interact with each other, therefore there may be a relationship between ITG success and order of implementation resulting in certain ITG frameworks to be more interesting during certain stages of ITG maturity then others.

3. Research design

This section describes the objective of this research, as well as its knowledge problems (Wieringa, 2014). In addition, the research structure is discussed.

3.1 Research objective

The objective of this research is to help the Radboudumc adopt the appropriate ITG framework.

This requires answering a series of knowledge questions. The first aims to get a better overview of the existing ITG frameworks, the second question aims at gathering information on the drivers and inhibitors of ITG frameworks for an academic medical centre and the third aims at gathering information on the drivers and inhibitors of ITG in the Radboudumc specifically.

3.2 Research questions

The main research question paraphrases the design objective of this research. Validation of the designed artefact should result in the artefact being the answer to this question.

Research Question: What is an appropriate IT governance framework for the Radboudumc and how should it be implemented?

To answer the research question, it is necessary to answer four knowledge questions, which are stated below. The deliverables of these knowledge questions can be found below the questions in italics.

1. Which IT governance frameworks are available for academic medical centres?
   A comprehensive list of the available IT governance frameworks that are available to academic medical centres.
2. What are the specific critical success factors for IT governance at the Radboudumc?
   A comprehensive list of critical success factors, and their importance, for an IT governance framework at the Radboudumc.
3. What is an appropriate IT governance framework for the Radboudumc?
   A framework from the list developed by answering the first research question that best fits the Radboudumc.
4. How should an IT governance framework be implemented at the Radboudumc?
   IT governance implementation principles and an IT governance implementation roadmap for the Radboudumc.

3.3 Methodology

These questions are answered by performing literature research and expert interviews.

The literature review is based on the method for gathering relevant literature described by Wolfswinkel, Furtmueller and Wilderom (2013). The first step was the selection of databases, in this case Scopus and Google Scholar. Scopus due to their larger database and greater coverage of Computer Science and Information Systems and Healthcare compared to others such as Web of Science and Google Scholar due to its ability to search gray sources (e.g. books, theses and white papers).

For the IT governance framework literature research this resulted in the following inclusion criteria:

- Studies whose main topic concerns IT governance frameworks
- Studies whose main topic concerns IT governance implementation

If a paper does not confirm one of these criteria, it is removed from the results.

The exclusion criteria were the following:

- Studies that are reported several times (only the most recent study is included)
- Papers that are not accessible through the libraries of the University of Twente or the Radboud University Nijmegen
- Studies that focus on the concept of IT governance rather than on IT governance frameworks

If a paper conforms to one of the criteria, it is removed from the results.

For the critical success factors of IT governance frameworks this resulted in the following inclusion criteria:

- Studies whose main topic is IT governance implementation drivers
- Studies whose main topic is IT governance implementation inhibitors
- Studies whose main topic is IT governance Critical Success Factors

If a paper does not confirm one of these criteria, it is removed from the results.

The exclusion criteria were the following:

- Studies that are reported several times (only the most recent study is included).
- Papers that are not accessible through the libraries of the University of Twente or the Radboud University Nijmegen.
- Studies that focus on IT governance implementation without mentioning drivers, inhibitors or Critical Success Factors

If a paper conforms to one of the criteria, it is removed from the results.

Since no review has been conducted to synthesize this information with regard to the healthcare domain, we have decided to start with one search term and then to add search terms that seemed relevant. For the IT governance framework literature review the term “IT governance framework” yielded all the relevant results. For the literature review concerning the drivers and inhibitors of IT governance frameworks we started with two search terms; “Drivers of IT Governance” and “Inhibitors of IT Governance”. We expanded this search with a third search term: “Critical Success Factors of IT Governance”.

To select the appropriate stakeholders of IT governance in the Radboudumc a stakeholder analysis has been conducted. We adopted the method of Pouloudi and Whitley (1997). They provide an interpretive research method for stakeholder analysis aimed at the healthcare domain. The method consists of the following steps:

1. Identify obvious groups of stakeholders
2. Contact representatives from these groups
3. (In-depth) interview them
4. Revise stakeholder map

Pouloudi and Whitley mention that stakeholder analysis is a cumulative and iterative approach and steps 1 to 4 should thus be repeated. This may cause the number of stakeholder to grow and the question remains when to stop. Lack of resources (e.g. time) is the most apparent reason to stop. The researcher has to define criteria to stop before starting the process (Pouloudi, 1998). In this case there is a single criterion to stop stakeholder analysis:

- A time constraint of four weeks to map and interview all the stakeholders

The experts identified and interviewed can be found in appendix A.

The semi-structured interviews were conducted using a short interview protocol, intended to ask open questions to allow the interview to focus on areas where interviewees wanted to go in-depth.

The interviews were recorded as digital audio files if the interviewees gave consent to do so.

The relevant sections of the audio files were then transcribed. In the case that the interviewee did not give consent as they felt the interview might cover confidential information, transcription took place during the interview and the interviewee was given the option to review the transcript to ensure it did not disclose confidential information.

After the drivers and inhibitors of ITG in the healthcare domain have been mapped, an additional round of interviews is conducted with experts to validate them. These experts were explained the answers to the knowledge questions. The experts interviewed during this round are the same as the experts interviewed during the initial stages of the research and any lessons learned from validation interviews and the cases are used to improve the selection process.

3.4 Research structure

To structure this research the model of Verschuren & Doorewaard (2000) is adopted.

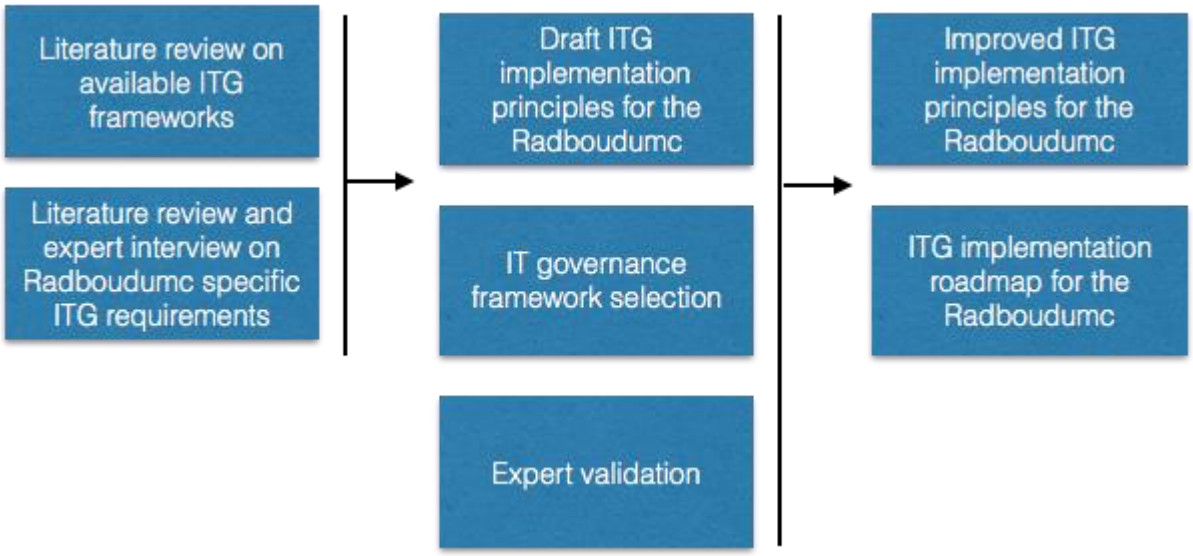

Figure 3.1: Phases, inputs and outputs of this research.

Chapter 4 contains background information on ITG frameworks available to the healthcare domain. Chapter 5 aims to gather information on Radboudumc specific drivers and inhibitors for an ITG framework, through a literature review as well as through expert interviews. Finally, in chapter 6, an appropriate ITG framework for the Radboudumc will be chosen. Finally, in chapter 7 the ITG implementation principles and the implementation roadmap are presented.

4. ITG frameworks for academic medical centres

The first knowledge question defined in our research was:

"Which IT governance frameworks are available for academic medical centres?"

To answer this question, a literature review has been conducted. The sections provide an integrated overview of the ITG frameworks available to academic medical centres and the final section provides a summary of the key findings. As described in the introduction ITG is defined as representing "*… the framework for decision rights and accountabilities to encourage desirable behaviour of IT*" (Weill, 2004). ITG frameworks are then frameworks that distribute decision rights and accountabilities to encourage desirable behaviour of IT. This section will first explore ITG frameworks available in literature and check whether they fulfil our definition of an ITG framework.

4.1 COBIT

The ITG framework that is most apparent in literature is COBIT. COBIT (Control Objectives for Information and related Technologies) is the leading research publications of ITGI (IT Governance Institute). Although its use is still relatively limited, it is becoming the most widely acknowledged set of guidance materials for ITG (Bakry & Alfantookh, 2006). It views ITG in the context of enterprise governance and it is based on the following principles:

- COBIT is aligned with business: COBIT enhances business and support benefits
- COBIT emphasises that IT resources should be used responsibly
- COBIT stresses that IT related risks are managed properly

Figure 4.1 provides a general view of COBIT (Bakry & Alfantookh, 2006). The figure shows COBIT's concern with the business requirements, and illustrates its three main dimensions:

- The required business information criteria that should be delivered by COBIT
- The IT resources that should be controlled by COBIT
- COBIT's IT processes that should be applied to the IT resources to achieve required business information criteria

The required business information criteria are concerned with the following:

- Quality issues including value and delivery of information
- Fiduciary in terms of: effectiveness and efficiency of operation, reliability of information, and compliance with laws and regulations
- Security in terms of: confidentiality, integrity and availability of information

The IT resources are considered to include the following:

- Data, representing both internal and external objects
- Applications systems, including both applications software and manual procedures
- Technology, that is the infrastructure, including: hardware, communications and networking, operating systems software, and database management systems
- Facilities, that is the resources housing and supporting all of the above
- People, that is the staff and their skills

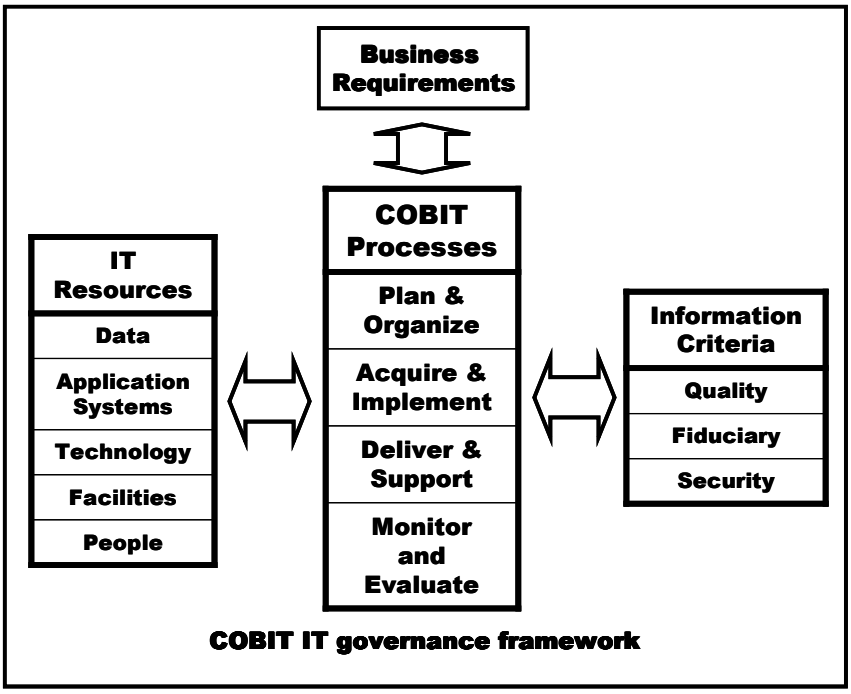

Figure 4.1: The basic structure of COBIT

The IT processes are of a multi-level structure, with the top level consisting of four main domains. These domains are associated with Deming's and Shewhart's cycle for quality development, known as PDCA (Plan, Do, Check, Act) cycle (Moen & Norman, 2009), and are given in the following against this cycle (Bakry & Alfantookh, 2006):

- P (plan): plan and organise
- D (do): acquire and implement
- C (check): deliver and support
- A (act): monitor and evaluate

Table 4.1 gives the number of processes, and the number of control objectives and activities associated with each of these four domains. The total number of processes of all domains is 34, while the total number of control objectives and activities is 318 (Von Solms, 2005).

Table 4..1: COBIT main domains and the PDCA quality cycle

Deming's & Shewhart's Cycle	COBIT Domain	Number of Processes	Number of Controls
Plan	PO: Plan and Organize	11	100
Do	AI: Acquire and Implementation	6	68
Check	DS: Deliver and Support	13	126
Act: Correct	M: Monitor and Evaluate	4	24
"Total"		34	318

Because COBIT is extremely audit-oriented, it provides excellent checklists for various aspects of IT within organisations (Anthes, 2004). One of the weaknesses of COBIT however, is that the COBIT framework is generic (Wessels & van Loggerenberg, 2006). It only documents the direction that IT must follow and not how to follow these directions. The most important shortcoming of COBIT is the fact that it dies not cater for continuous process improvement (Anthes, 2004).

There is the need to contextualise the use of COBIT within the environment of the hospital, i.e. it is necessary to validate that the COBIT framework has validity also in academic medical centres. COBIT satisfies our definition of ITG since it defines how IT processes deliver the information to achieve the business goals. It thus provides the framework for decision rights and accountabilities to encourage desirable behaviour of IT (Spremić, 2009).

Furthermore, a successful academic medical centre should be built on a solid framework of data and information (Lapão, 2011). Otherwise the lack of proper information will jeopardise the decision making, consequently leading to failure. COBIT defines how IT processes deliver the information to achieve the business goals. This delivery should be controlled through the 34 high-level processes mentioned in table 4.1. COBIT further identifies which of the seven information criteria (effectiveness, efficiency, confidentiality, integrity, availability, compliance and reliability), as well as which IT resource (people, applications, information and infrastructure) are important for the IT processes to fully support the hospitals' care services. The key to maintaining profitability in a technologically changing environment, such as an academic medical centre, is how well one can maintain control. COBIT's control objectives provide the critical insight and the guidance needed to delineate a clear policy and good practice for IT management control. Included are the 'statements of desired results' or the purposes to be achieved by implementing the control objectives throughout the high-level IT processes.

4.2 ITG balanced scorecard

A framework that has been developed by two of the experts from the research community is the ITG Balanced Scorecard (ITG BSC). This framework starts with the Balanced Scorecard (BSC) as its foundation since the use of the BSC has become widespread as a performance measurement management system (Van Grembergen & De Haes, 2005). The fundamental premise of the BSC approach is that the evaluation of a firm should not be restricted to a traditional financial evaluation, but should be supplemented with measures concerning customer satisfaction, internal processes, and learning and growth. Results achieved within these additional perspectives should assure future financial results and drive organisations toward its strategic goals while keeping all four perspectives in balance.

By using the BSC to its full extent, it enables IT management and the board to achieve their objectives (Van Grembergen & De Haes, 2005). The BSC is not only a performance management system but also, at the same time, a management system when causal relationships between metrics are properly implemented. According to Van Grembergen and De Haes (2005) the ultimate goal of the development and implementation of an ITG process is attaining the fusion of business and IT and, consequently, achieving better financial results. Therefore, it is logical that the ITG BSC starts with a corporate contribution perspective. As shown in figure 4.2, the other three perspectives have a causal relationship with corporate contribution and, amongst each other, cause-and-effect relationships.

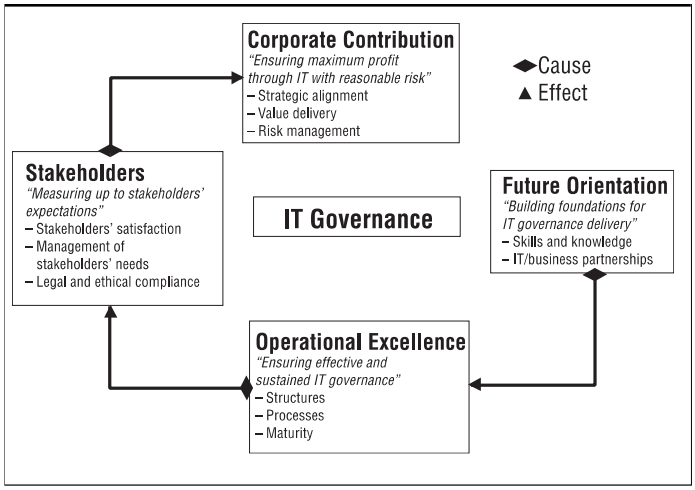

Figure 4.2: ITG BSC perspectives and their cause-and-effect relationships

The corporate contribution dimension evaluates the performance of the ITG process. A well-balanced ITG process must enhance business profit through IT while mitigating the risk related to IT (Van Grembergen & De Haes, 2005). The key issue as depicted in figure 4.3, are strategic alignment, value delivery and risk management. These three issues are seen by the IT governance institute (ITGI) as main concerns of IT Governance.

Perspective	**Corporate Contribution**
Mission	Ensuring maximum profit while mitigating IT-related risks
Objectives	***Strategic Alignment***
	Measures • Weighted governance performance • Strategic match of major IT projects • Percentage of development capacity engaged in strategic projects • Percentage of business goals supported by IT goals
	Value Delivery
	Measures • Business unit performance management • Business value of major IT projects based on ROI, NPV, IRR, PB • Ratio IT costs/total turnover • IT costs charged back to the business
	Risk Management
	Measures • Number of new implemented IT security initiatives and security breaches • Attainment of disaster recovery plans • Number of IT audits performed and reported shortcomings

Figure 4.3: Corporate contribution

The goal of both, the BSC and the ITG BSC, is to obtain better corporate financial results (Van Grembergen & De Haes, 2005). Improving ITG performance is the main reason for the ITG BSC, therefore measuring is not enough. The ITG BSC must be implemented as a management system. When the measurement indicates that there are major problems with risk management (corporate contribution), a strategy may be to adequately improve the disaster recovery planning through a COBIT and ITIL implementation.

With an ITG BSC, organisations can empower their board, CEO, CIO, executive management, and the business and IT participants by providing them the information that is needed to act and achieve a better fusion between business and IT and, consequently, reach better results. However, the ITG BSC fails to be "… *the framework for decision rights and accountabilities to encourage desirable*

behaviour of IT" since it does not clearly distribute decision rights nor accountabilities, therefore according to our definition the ITG BSC is no viable ITG framework.

4.3 ITIL

ITIL (Information Technology Infrastructure Library) was originally developed by the UK Government and consists of a set of best practices that is collected and updated by a wide range of practitioners (Wessels & van Loggerenberg, 2006). The ITIL framework is a 'process-based approach to the IT activity' and ITIL is not focused on technology, but rather of processes critical to organisations (Kim, 2003).

ITIL comprehends the following main steps (Steinberg, 2008): process assessment, organisational assessment, technology assessment, governance assessment, assessment finding analysis, recommendation actions identification. The aim of an organisation assessment is to analyse how well the organisation supports an ITIL improvement initiative. The output of this assessment is (Lapão, 2011):

- Highlight organisational readiness for change
- Highlight skill gaps
- Identify current IT Service Management roles and responsibilities
- Include stakeholder analysis
- Identify organisational assessment findings

To assist with the task of identifying roles and responsibilities and communicating levels of authority, the RACI matrix can be used as a useful management and communication tool (Lloyd, Peters, Rupchock, & Wilkinson, 2001). The RACI matrix can assist the initial stakeholder analysis and project planning stage, which is also used to map out processes and to identify areas of responsibility at the task level, which are critical in the implementation stage (Lapão, 2011).

The main strength that ITIL offers is its reputation. ITIL has shown itself to be entrenched and mature by providing a detailed focus on the quality of IT production and operational processes. Because ITIL is based on best practices, it is an excellent tool for enhancing operational systems (Anthes, 2004). ITIL does have a few limitations. However, ITIL concerns the processes themselves rather than the decisions rights and accountabilities regarding the IT processes, therefore ITIL fails to be "*… the framework for decision rights and accountabilities to encourage desirable behaviour of IT."*

4.4 ISO 17799 & ISO 27001

ISO 17799 is an international information security standard (Von Solms, 2005). It is divided into ten sections with 36 objectives. Each objective is divided into sub-objectives. The upside of using ISO 17799 for IT Governance is that is it more detailed than COBIT on information security, and provides more guidance on precisely how things must be done.

Because of this more detailed and technical orientation of ISO 17799, it is in many cases the framework of choice of IT managers and Information Security Managers. The downside of ISO 17799 is that it is a standalone guidance, not integrated into a wider framework for ITG (Von Solms, 2005). ISO 27001 is the revised ISO 17799 and consists of 10 chapters, 37 objectives and 134 best practices concerning information security.

As mentioned before, the downside of using ISO 27001 for ITG is that it only provides guidance to the information security section of IT. However, combining ISO 27001 and COBIT seems logical to get the benefits from both worlds. The wider reference framework by COBIT and the more detailed guidelines provided by ISO 27001 for information security. The synergy of combining these two frameworks can be substantial (Von Solms, 2005).

ISO 27001 is the "*… the framework for decision rights and accountabilities to encourage desirable behaviour of IT"* but only with regard to the information security. In combination with COBIT it covers ITG completely and therefore ISO 27001 is considered to be a viable ITG framework.

4.5 ISO 38500

ISO 38500 positions IT at a strategic level and looks at it from a demand standpoint; "How can we use IT?" It also emphasises the board's behaviour around the use of IT (Sylvester, 2011).

The objective of ISO 38500 is to provide a structure of principles for directors (including owners, board members, directors, partners and senior executives) to use when evaluating, directing and monitoring the use of IT in their organisations. This standard provides a structure for the effective governance of IT to assist those at the highest level of organisations to understand and fulfil their legal, regulatory and ethical obligations regarding the organisations' use of IT. Directors should govern IT through three main tasks (Sylvester, 2011):

- Evaluate the current and future use of IT
- Direct preparation and implementation of plans and policies to ensure that the use of IT meets business objectives
- Monitor conformance to policies and performance against the plans.

The standard sets out six principles for good corporate governance of IT. The principles express preferred behaviour to guide decision making. The statement of each principle refers to what should happen, but does not prescribe how, when or by whom the principles would be implemented; these aspects are dependent on the nature of the organisation implementing the principles.

Each of the principles is then tied into the model to provide a best practice for each principle (see Figure 4.4).

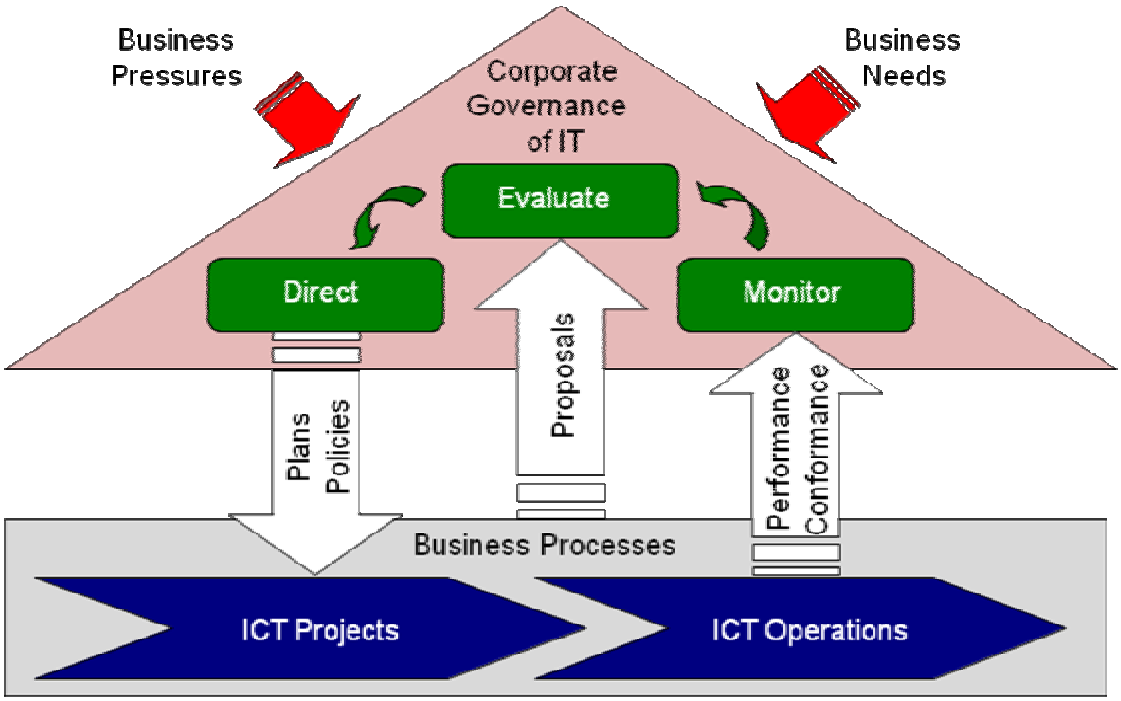

Figure 4.4: ISO 38500: Model for Corporate Governance of ITISO 38500 is driven from the top down, IT departments need to make sure that they are ready for the new demands the board will propose. Initially, an assessment if readiness from an IT point of view would be a good idea so that the department is not found wanting, should the board adopt the standard. In principle, if COBIT maturity is high for governance processes, the department should be in a good condition.

ISO 38500 is not an open standard and it can therefore not be verified that it is "*… the framework for decision rights and accountabilities to encourage desirable behaviour of IT"* and therefore is not considered as a viable IT governance framework.

4.6 IT governance frameworks summary

This chapter has listed five ITG frameworks that are available to academic medical centres. Two of them are viable ITG frameworks (COBIT and ISO 27001) whereas the other three, the ITG BSC, ITIL and ISO 38500, have been omitted from the list. The ITG BSC fails to clearly distribute decision rights or accountabilities, ITIL concerns the processes themselves rather than the decisions rights and accountabilities regarding the IT processes and ISO 38500 is not an open standard and could thus not be verified to be a framework for decisions rights and accountabilities to encourage desirable behaviour of IT.

The two remaining frameworks have a different scope. COBIT focusses on all aspects of ITG. Its 34 processes and 318 control objectives cover ITG from planning and organising IT, acquiring and implementation, delivery and support to monitoring and evaluation. Because COBIT is extremely audit-oriented, it provides excellent checklists for various aspects of IT within organisations. One of the weaknesses of COBIT however, is that the COBIT framework is generic.

The second ITG framework, ISO 27001, only concerns information security. It therefore does not provide us with a framework for the whole ITG spectrum. However, combining ISO 27001 and COBIT seems logical to get the benefits from both worlds. The wider reference framework by COBIT and the more detailed guidelines provided by ISO 27001 for information security. The synergy of combining these two frameworks can be substantial.

4.7 IT governance framework selection

This section answers our third research question:

"What is an appropriate IT governance framework for the Radboudumc?"

To select the most appropriate framework we take a look at which framework brings the best achievable results. It is not about which framework is most complete (that would be COBIT since it has a larger scope), nor about which framework gives the most guidance (ISO 27001 since it goes more in depth). The most appropriate framework enables the Radboudumc to start implementing successful ITG.

One of the major aspects in terms of support for ITG and the ITG framework is how well it is known. Looking at COBIT and ISO 27001 it is fair to state that ISO 27001 is best known throughout the Radboudumc. COBIT is unknown by all except a few IT managers who might have heard of the framework. This is partially due to the nature of COBIT, it is abstract and only concerns high-level IT processes. ISO 27001 on the other hand gives more in-depth knowledge on information security. Especially in healthcare, information security has gained a lot of publicity during the last years. Documentaries, news items and newspapers have written about information security, and the lack thereof, in hospitals multiple times during 2016. One example showed how certain hospitals failed to digitalise their patient records safely. The hospitals had outsourced the digitalisation process and the company in charge paid prisoners to digitalise the files. Scandals such as these can be prevented by good information security.

Additionally, information security, specifically ISO 27001, can aid research at the Radboudumc directly. More often than not subsidies (grants) for research contain a specific criterion that states that the academic medical centre (or other body conducting the research) has to be ISO 27001 certified, to ensure information security is up to standard.

A third aspect is how well known the framework is within the branch. Looking at COBIT, only IT managers and some IT employees are knowledgeable about the framework. Concerning ISO 27001, many more professionals are knowledgeable about the framework. This is because of the resemblance between NEN 7510 (the Dutch standard for information security in healthcare) and ISO 27001. Due to the resemblance to NEN 7510, ISO 27001 principles are known by governmental policy makers and researchers alike, granting it more support.

Furthermore, we have found during the interviews that a 'big bang' approach would not work in the Radboudumc. Since everyone and everything has to earn its place it is important to prove something before implementing everything and thereby changing everything. ISO 27001 has a smaller scope and is therefore more applicable when starting small. It only spans information security, which can thus be used as the start for ITG at the Radboudumc. It is thus clear that the most appropriate framework for ITG at the Radboudumc is ISO 27001.

5. Drivers and inhibitors of IT Governance

The second knowledge question in chapter three investigates what the drivers and inhibitors of an IT governance framework are:

"What are the specific drivers and inhibitors for an IT governance framework at the Radboudumc?"

This chapter lists a collection of such drivers and inhibitors. This list is deducted from both literature and interviews with experts and is composed of three categories. The first section of this chapter will discuss drivers of ITG, followed by inhibitors of ITG in section 5.2. Section 5.3 is used to describe the interviews and all drivers and inhibitors are summarised in section 5.4

5.1 Drivers

Drivers ensure a successful implementation and realisation of ITG. Drivers of ITG consist of enablers and critical success factors (CSFs). Enablers and CSFs are both considered to be the limited number of areas in which satisfactory results will ensure a competitive performance for the organisation (Rockart & van Bullen, 1986). Drivers of ITG are thus those enablers and CSFs for which satisfactory results ensure a competitive performance of ITG for the organisation.

Drivers are used by organisations to focus on a number of factors that help to define and ensure the success of the business, and in this way help the organisation and its personnel to understand the key areas in which to invest their resources and time. In IT governance CSFs are vital to focus areas such as strategic alignment, IT value delivery, risk management, resource management and performance management (Kurti, Barolli, & Sevrani, 2014; Nfuka & Rusu, 2011; Nfuka & Rusu, 2010).

CSFs have been widely researched due to their importance (Tan, Cater-Steel, Toleman, & Seaniger, 2007). However, in the area of ITG, few CSFs studies have been undertaken. These studies include the work of the IT Governance Institute (ITGI) who have established several CSFs emphasising IT as an integral part of the enterprise and the importance of awareness, communication, stakeholder management and monitoring across the organisation (ITGI, 2003). Furthermore, and ITGI sponsored study on ITG practices through 50 CIOs globally indicated six CSFs (PwC & ITGI, 2007). These CSFs include communication and emphasise on senior management support, change management, guidelines and defining and tracking benefits. Also Bowen et al. (2007) identified several CSFs, including shared business/IT understanding, involvement of IT committees and well-communicated IT strategies and policies.

Given the similarities and different levels of granularity of ITG related CSFs in 15 different papers (Nfuka & Rusu, 2010; Bowen et al., 2007; Guldentops, 2004; Haes & Grembergen, 2008; ITGI, 2003; Kurti et al., 2014; Lee, Lee, Park, & Jeong, 2008; Lee, Lee, & Jeong, 2008; Luftman & Brier, 1999; Nfuka & Rusu, 2011; Nfuka & Rusu, 2010; Peterson, Parker, Ribbers, Peterson, & Parker, 2002; PwC & ITGI, 2007; Tan et al., 2007; Teo & Ang, 1999; Weill & Ross, 2004) we harmonised them logically. This harmonisation took into account constraints in the environment of an academic medical centre, key ITG focus areas (ITGI, 2003) and the fact that IT value to be realised is due to effective and efficient IT delivery, innovation and business impact (Peterson, 2004). The result is 18 unique CSFs (Table 5.1).

Table 5.5.1: Identified and harmonised CSFs from the research literature

	Nfuka & Rusu - 2010	ITGI & PWC - 2006	Bowen et al. - 2007	Ribbers et al. - 2002	Teo & Ang - 1999	Luftman et al.- 1999	De Haes & Van Grembergen - 2008	Tan et al. - 2007	Weil - 2004	Guldentops - 2004	ITGI - 2003	Nfuka & Rusu - 2011	Kurtia et al. - 2014	Lee et al. - 2008	Lee et al. - 2008a
Communication	x	x	x											x	x
Senior Management Support	x	x			x	x		x	x	x		x	x	x	x
Change Management	x	x													
Defining and tracking benefits	x	x													
Not over-engineering the process		x													
Business/IT shared understanding	x	x		x	x		x								
Involvement of IT committees							x								
Balance of business/ IT in IT decisions	x		x	x				x				x	x	x	x
Stakeholder management	x			x	x										
IT Leadership	x				x		x								
Need for guidelines	x	x			x		x								
Staff and develop competitive IT professionals	x				x										
Define and align business and IT strategies	x			x	x										
Define key decisions and who should make them	x														
Standardise and integrate IT systems	x														
Provide IT infrastructure to support creation and sharing of IT services	x														
Manage mitigation of risks	x														
IT provides efficient and reliable services to user departments															

5.2 Inhibitors

Inhibitors are these factors that have a negative impact on the results of an organisation, considering a certain topic. For ITG the correlation between a firm's performance, the possible existence of underlying inhibitors interrupting companies' optimal ITG is sensitive (Lee et al., 2008). Luftman et al. (1999) identify multiple inhibitors of ITG such as IT and the business lack

close relationships, IT does not prioritise well and IT fails to meet commitments. Furthermore, they found that most inhibitors pertain to possible social and managerial issues rather than technical factors.

In addition to these inhibitors, Lee et al. (2008) develop a framework for ITG inhibitors which represents seven categories: inadequate stakeholder management, lack of clear ITG principles and policies, inadequate organisational cultures, lack of communication, lack of clear ITG processes and inadequate support for resources (time and financial).

Given the similarities of ITG related inhibitors in the two different papers (Lee et al., 2008; Lee et al., 2008) we harmonised them logically. This harmonisation took into account constraints in the environment of an academic medical centre and the fact that IT value to be realised is due to effective and efficient IT delivery, innovation and business impact (Peterson, 2004). The result is seven unique inhibitors (Table 5.2).

Table 5.2: Identified and harmonised inhibitors from the research literature

	Lee et al. - 2008	Lee et al. - 2008a
Inadequate stakeholder management	X	X
Lack of clear ITG principles and policies	X	X
Inadequate organisational cultures	X	X
Lack of communication	X	X
Lack of clear ITG processes	X	X
Inadequate support for financial resources	X	X
Inadequate support for time resources	X	X

5.3 Interviews

To validate the CSFs and inhibitors found in literature, 14 interviews have been conducted with experts at the Radboudumc. This includes IT professionals such as the CIO, security officer and the portfolio manager as well as professionals from the business (e.g. from a financial or healthcare department). A complete list of interviewees can be found in appendix A.

Out of the 18 CSFs found in literature 17 were mentioned during the interviews. The CSF mentioned in literature but not during the interviews is the staffing and development of competitive IT professionals. One of the interviewees mentioned that it is not the question whether ITG can work for the Radboudumc, or even whether the Radboudumc should want ITG. The Radboudumc needs good ITG but, according to this interviewee, there are no easy options. The Radboudumc does not excel at (general) governance, nor in enforcing policies.

One aspect that is important at the Radboudumc is the autonomy of the healthcare professional. These professionals are used to making their own decisions and want to be part of every decision made in the hospital. Therefore, it is vital that the board of directors of the Radboudumc shows guidance, which, according to the interviews, it should do more actively. Furthermore, multiple interviewees state that for ITG to be successful it should enable the healthcare professional and not hinder the healthcare professional in any way. Even more so, it is

stated that if ITG interferes with the primary process of the healthcare professionals it is doomed to fail.

It is thus clear that tailoring ITG to the culture at the Radboudumc is vital. One more cultural aspect that should be considered is that the Radboudumc has an open culture with regard to sharing information and data. Addressing colleagues on their responsibilities however, is not something that is part of the culture at the Radboudumc. This is partly due to the fact that ownership is diffuse. Because the healthcare professional is used to be part of every decision made at the Radboudumc it is not evident that the decisions made by governance bodies are accepted.

Since the decisions made by governance bodies are not always accepted it is of utmost importance to conduct good stakeholder management. One of the interviewees states that it is hard to get the right people a seat at the table. This is partly due to the fact that the Radboudumc consists of 52 financially independent departments. This results in 52 internal customers, all with different needs. This makes it hard to make decisions for the whole Radboudumc instead of for one department. Furthermore, since the autonomous professionals are used to making their own decisions, a top-down implementation of ITG will not work. One has to earn its place at the Radboudumc, meaning that one has to prove the value of ITG if it is to be a success.

To earn ITG a place at the Radboudumc communication is key. At this time multiple ITG bodies exist at the Radboudumc but they are not visible enough. If you get to talk to the right employee they know these bodies exists but the majority of the employees at the Radboudumc does not know of the existence of the ITG bodies and if they do, they are most likely to be unknown of the use, goals and coherence of the ITG bodies. Here, the IT department could learn from the Human Resources department (HR). HR has dedicated employees to serve all other employees when they have relatively simple questions with regard to HR. When questions become more complex, every department has its own HR representative being able to help them answer their questions or get directed to the right people in the department to develop an answer to the questions. This structure is clear and well communicated throughout the Radboudumc. For the IT department, no such thing currently exists. The relatively simple questions (my telephone does not work etc.) can be asked at the service desk but when it concerns a more complex question (is there any software already available that can aid my department's processes?) there is no clear 'counter' where one can go with its questions. Communicating which ITG bodies exist, what they do and when you can contact them is therefore a vital part of successful ITG implementation at the Radboudumc.

Giving the autonomous professionals enough room and supporting employees instead of hindering them means that ITG should not create a paper reality or start a bureaucracy. As one of the interviewees stated, ITG should be like a well-tailored coat, warm and comfortable whilst still being able to move freely. Not over-engineering the process is thus important for the Radboudumc. A complete list (in Dutch) of the CSFs that were found most prominently during the interviews can be found in appendix B. An overview of the CSFs identified during the interviews can be found in Table 5.3.

Table 5.5.3: Identified and harmonised CSFs from the interviews

	Interviewee 1	Interviewee 2	Interviewee 3	Interviewee 4	Interviewee 5	Interviewee 6	Interviewee 7	Interviewee 8	Interviewee 9	Interviewee 10	Interviewee 11	Interviewee 12	Interviewee 13	Interviewee 14
Communication	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Senior Management Support		x		x			x		x			x	x	x
Change Management		x			x		x							
Defining and tracking benefits														
Not over-engineering the process		x			x		x							
Business/IT shared understanding		x		x	x		x							
Involvement of IT committees							x							
Balance of business/ IT in IT decisions		x		x	x	x	x	x	x	x	x	x		
Stakeholder management		x		x	x		x							
IT Leadership				x			x							
Need for guidelines		x		x			x							
Staff and develop competitive IT professionals														
Define and align business and IT strategies				x	x		x							
Define key decisions and who should make them		x		x			x							
Standardise and integrate IT systems														
Provide IT infrastructure to support creation and sharing of IT services														
Manage mitigation of risks		x		x										
IT provides efficient and reliable services to user departments							x							

Looking at the inhibitors that were found in literature it is clear that inadequate stakeholder management, the lack of clear ITG principles and policies, inadequate organisational cultures, a lack of communication and a lack of a clear ITG process are the biggest inhibitors to ITG success in the Radboudumc. There is only one interviewee who identified the scarcity of resources (both financial and time constraint). A complete list (in Dutch) of the inhibitors that were found most prominently during the interviews can be found in appendix C. An overview of the inhibitors identified during the interviews can be found in Table 5.4.

Table 5.5.4: Identified and harmonised inhibitors from the interviews

	Interviewee 1	Interviewee 2	Interviewee 3	Interviewee 4	Interviewee 5	Interviewee 6	Interviewee 7	Interviewee 8	Interviewee 9	Interviewee 10	Interviewee 11	Interviewee 12	Interviewee 13	Interviewee 14
Inadequate stakeholder management	x	x	x	x	x	x	x		x	x	x	x	x	x
Lack of clear ITG principles and policies	x	x	x	x	x	x	x		x	x	x	x		
Inadequate organisational cultures	x	x	x	x	x	x	x		x	x	x	x		x
Lack of communication	x	x	x	x	x	x	x		x	x		x	x	x
Lack of clear ITG processes	x	x	x		x	x	x		x	x	x	x	x	
Inadequate support for financial resources		x												
Inadequate support for time resources		x												

5.4 Chapter Summary

Looking at the identified CSFs and inhibitors it is clear that inhibitors can function as a CSF as well. By converting the inhibitors to CSFs we get one clear overview of the factors influencing ITG success in the organisation which helps us to not over-engineer the process. The conversion goes as follows:

- 'Inadequate stakeholder management' is a part of 'Stakeholder management'
- 'Lack of clear ITG principles and policies' is a part of 'Need for guidelines'
- 'Inadequate organisational cultures' is a part of 'Change management'
- 'Lack of communication' is a part of 'Communication'
- 'Lack of clear ITG processes' is a part of 'Need for guidelines' and 'Define key decisions and who should make them'
- 'Inadequate support for financial resources' is a part of 'Change management'
- 'Inadequate support for time resources' is a part of 'Change management'

Combining the harmonised CSFs from the research literature and the interviews gives us 18 CSFs. It is clear that, in both literature and the interviews, the need for guidelines and the shared understanding of business and IT are the most important CSFs (mentioned 23 and 25 times respectively. At the Radboudumc the need for guidelines and the shared understanding of business and IT can be seen in the fact that, according to the interviewees, Radboudumc does not excel at (general) governance, nor in enforcing policies. Defining and aligning IT and business strategies and stakeholder management (both mentioned 20 and 21 times respectively) follow closely. Since the decisions made by governance bodies are not always accepted it is of utmost importance to conduct good stakeholder management. One of the interviewees states that it is hard to get the right people a seat at the table. This is partly due to the fact that the Radboudumc consists of 52 financially independent departments. This results in 52 internal customers, all with different needs. This makes it hard to make decisions for the whole Radboudumc instead of for one department. Overall communication and balance of business and IT in IT decisions and senior management support are apparent CSFs as well (mentioned 19, 18 and 18 times respectively). At this time multiple ITG bodies exist at the Radboudumc but they are not visible enough. If you get

to talk to the right employee they know these bodies exists but the majority of the employees at the Radboudumc does not know of the existence of the ITG bodies and if they do, they are most likely to be unknown of the use, goals and coherence of the ITG bodies.

6. Implementing an IT governance framework at the Radboudumc

This chapter starts with the development of implementation principles for the Radboudumc in section 6.1. Then, in section 6.2, the first steps of implementing ISO 27001 at the Radboudumc will be discussed. Finally, in section 6.3, an ITG implementation Roadmap for the Radboudumc is presented.

6.1 Developing implementation principles

As stated in section 5.3, making sure that the autonomous professionals at the Radboudumc are not hindered but rather supported is key if ITG wants to be successful at the Radboudumc. The first implementation principle therefore is:

"Our employees work autonomously"

At the Radboudumc it is unwise to interfere too much with the autonomy of the employees and it is therefore important that, whenever possible, the autonomy of the employees is not restricted. ITG should only restrict the autonomy of the employees of the Radboudumc when no other options are available. In addition, the autonomy of the employees of the Radboudumc ensures that a process for exception has to be in place. The need for specific wishes will arise. To enable ground-breaking, innovative research, healthcare and education, ITG should embrace this opportunity.

At the same time, multiple interviewees have stated that certain internal processes at the IT department do not meet standards. This diminishes the trust that the organisation has in the IT department which has a negative impact on ITG success and acceptance. In addition, it is stated multiple times that one has to earn its place in the Radboudumc and that recognising and accepting authority of governance bodies is not a given at the Radboudumc. Our second implementation guideline therefore is:

"Measure twice, cut once[1]"

This principle implies that during the implementation of ITG, progress is measured and actions are undertaken one by one. Progress therefore becomes visible to the organisation and the added value of ITG will become known.

Another aspect that was mentioned during the interviews is communication. The third implementation principle therefore is:

"Communication is everything"

There are two major aspects to communication during ITG implementation at the Radboudumc. The first is communication among stakeholders. Every interviewee understood the importance of ITG but almost every single one of the interviewees did not know where to start and who to start with. To make sure the correct people are seated at the ITG table, communication with stakeholders is vital. The second aspect of communication during ITG implementation at the Radboudumc is the communication of ITG initiatives and successes. During the course of the interviews it has become clear that multiple ITG initiatives are already taking place at the Radboudumc. They are however not visible enough. Not everyone knows these initiatives exist or

what their goals are. It is therefore important to create a common understanding of the ITG initiatives at the Radboudumc.

The interviewees agreed that the implementation principles are clearly expressed but can still be considered as too general. Some individuals were searching for answers that the framework itself can help provide such as; "How can IT tasks and responsibilities be distributed in the most optimal way?". Since these kind of questions need to be answered to implement ISO 27001 (or, when considering the whole IT spectrum and not just information security, COBIT) they are important. However, ISO 27001 (and COBIT) have these questions embedded. These questions are therefore not added to the implementation principles.

Another important comment is that an exception process is risky. During implementation of ISO 27001 we have to remind ourselves that the possibility of making exceptions has to be possible, but these should be true exceptions. This process could be used by many departments as an excuse to exclude themselves from ITG, rendering the efforts to implement ITG useless. To mitigate this risk and at the same time create room for exceptions, a clear and thorough process of 'exception acceptance' will be needed.

6.2 Implementing ISO 27001 at the Radboudumc

To implement ITG at the Radboudumc we have developed a roadmap consists of eight milestones. Every milestone consists of an action (why, what, who and how), stakeholder actions (why, what, who and how). Furthermore, for every milestone the three implementation principles are elaborated.

First of all, a baseline has to be defined for ITG and information security at the Radboudumc. This can be done by conducting a mock audit. This will test every aspect of ISO 27001, in the current situation at the Radboudumc. This will provide the Radboudumc with a baseline for information security and ITG. At this point, the identified stakeholders are the compliance and security officer and the management team of the IT department. The mock audit requires guidance from the compliance and security officer during the audit itself and cooperation from the IT management team. The mock audit does not directly interfere with the work or autonomy of any of the employees at the Radboudumc but the mock audit will help measure progress and success later on and therefore is a direct result from the second implementation principle: Measure twice, cut once. To have a clear ITG baseline, the results of the mock audit needs to be communicated to the departments of the Radboudumc, together with examples of how the departments can help in improving ITG and information security.

The second step will then be to conduct a stakeholder analysis. This will ensure that the appropriate stakeholders will take part in the ITG implementation process. In turn, this will lead to higher adoption rates and ensure good communication. These stakeholders can then aid in communicating ITG to the rest of the Radboudumc. The stakeholder action here is to let themselves be interviewed and help identify other (potential) stakeholders. Part of the interview makes clear how ITG can aid the professional rather than limit them in their autonomy. By starting with the obvious stakeholders and searching for other potential stakeholders during the ITG implementation process, we make sure that we involve the correct stakeholders at every step. This is a clear example of measuring twice (or even more often) and cutting once. Finally, by including the appropriate stakeholders at every step, communication will be easier. These stakeholders can be used to communicate the why, what and how of every step of the implementation process, which will significantly increase support for ITG.

The third step is generating support for ITG. This can only be done by involving the appropriate stakeholders and creating a shared understanding of ITG and its added value. Communication is vital and if this step is unsuccessful, ITG is doomed to fail. This is done by involving the stakeholders and finding examples of how ITG can benefit the Radboudumc in

general and care providers specifically. The stakeholders aid the compliance & security officer in finding ways in which ITG can provide benefits directly to the professionals. Furthermore, multiple stakeholders are consulted before making the first step which shows how the second implementation principle is used during this step. Finally, stakeholder management and generating support for ITG are true examples of the third implementation principle: Communication is everything.

The fourth step is defining a process for exceptions. Since the employees at the Radboudumc work as autonomously as possible and it is a wish to be able to deviate from regular ITG processes and policies, exceptions must be made. To ensure that only those exceptions that need to be made, are made, a process is necessary. If there would be no process, in which all the appropriate stakeholders have a role, more exceptions then regular policies could be the result.

ISO 27001 consists of multiple chapters which are intertwined on most subjects. This can best be illustrated by an example. Consider a well-functioning and safe WiFi, usable by employees and guests of the Radboudumc. This subject covers parts of chapters 5, 7, 8, 9, 10, 11, 12, 13, 14 and 15 of the ISO 27001 framework. Before starting the actual implementation of ISO 27001 it is necessary to define assumptions concerning information security. This has to be done before starting the implementation of ISO 27001 since the chapters of ISO 27001 are inseparable and need a common vision. The vision for the Radboudumc, as defined by their security officer, is:

"In the following years, the Radboudumc focusses on increasing information security and further professionalization of the information security function in the organisation. Reliable information is vital for proper functioning of the Radboudumc and the basis for the protection of patients' rights. This requires an integral approach good commissioning and risk awareness. Each organisational unit is involved."

The assumptions with regard to information security that the Radboudumc makes to help realise this vision are:

- The information security policies of the Radboudumc are in line with the general policies of the Radboudumc and relevant national and European laws and regulations
- The information security policies are based on the code of information security (NEN/ISO 27001/2)
- The information security policies are set by the board of directors. The board of directors periodically (at least once every two years) reviews the information security policies.

The fifth step is to implement chapter 6 of ISO 27001; organisation of information security. This is due to the nature of the Radboudumc and the extreme importance of stakeholder management. This chapter makes sure that the organisation lays out the roles and responsibilities for information security management, and allocates them to individuals. Defining the roles and responsibilities before developing the policies ensures that the correct stakeholders can be involved from the start. This in turn helps to see the policies not as restricting the freedom of the employees but rather as enabling them to deliver better and safer work. Furthermore, having the right stakeholders involved from the beginning onwards will help when defining a process for specific exceptions and help communication of the policies. In co-operation with the security officer of the Radboudumc we have developed strategic information security policies (in Dutch), starting with the organisation of information security.

The sixth step is then to implement the remaining chapters of ISO 27001. This will enable the Radboudumc to gain control of information security and the underlying processes.

The seventh step of ITG implementation at the Radboudumc is to achieve ISO 27001. This will measure the success of the implementation and help research to be granted more research (as ISO 27001 certification is a criterion that is more and more common).

The eighth and final step of the roadmap is the start of a new one, the start of Cobit. As stated in this research Cobit has a much broader scope (the whole of IT instead of only information security). The roadmap can be found in figure 6.1. This will help the Radboudumc to truly take ITG and the department as a whole, to the next level of professionality. An overview of the actions, stakeholder actions and implications of the implementation principles can be found in tables 6.1 until 6.8.

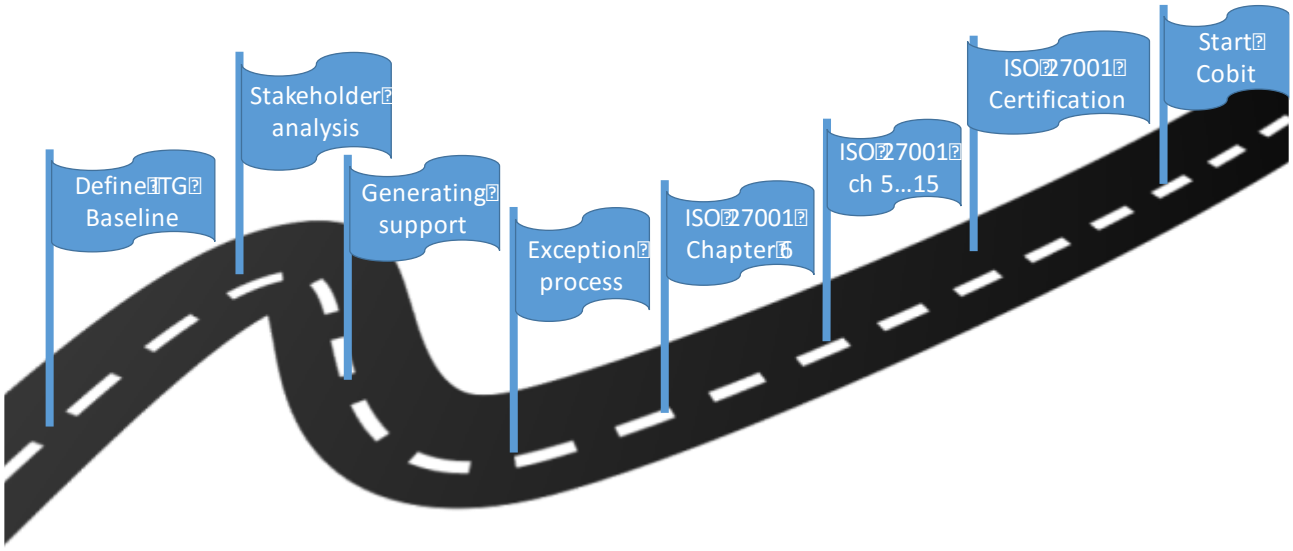

Figure 6.1: ITG roadmap for the Radboudumc

Table 6.1: The first step of ITG implementation at the Radboudumc

Step	Action			
Define ITG Baseline	*Why*	*What*	*Who*	*How*
	Defining the 'as is' situation	Define ITG baseline	External Auditor and compliance & security officer	Mock audit
		Stakeholder	Action	
	To increase the reliability of the 'as is' situation	Cooperate with and give guidance to the auditor	Mngmt team of the IT dept, compliance & security officer	Showing the auditor around and providing him with appropriate access
	Implementation Principle			
	Our employees work autonomously	*Measure twice, cut once*	*Communication is everything*	
	The mock audit does not interfere with the autonomy	Help measure progress and results later on	Communicate results and examples to departments	

Table 6.2: The second step of ITG implementation at the Radboudumc

Step	Action			
Stakeholder analysis	*Why*	*What*	*Who*	*How*
	Involve the right people	Stakeholder analysis	Compliance & security officer	(1)Identifying obvious groups of stakeholders, (2)contacting reps from these groups,(3) interviewing them and (4)revising stakeholder map
		Stakeholder	Action	
	To involve the right people and smooth the overall implementation of ITG	Participate in interviews ITG and help identify other potential stakeholders	All identified stakeholders, starting with the obvious group (that were interviewed during this study, see appendix A)	Provide the compliance & security officer with answers and potential stakeholders
	Implementation Principle			
	Our employees work autonomously	*Measure twice, cut once*	*Communication is everything*	
	The interviews make clear ITG is there to support the professional and not to hinder them	Stakeholder analysis is a continuous process. Stakeholders identified during later steps will be included.	Ensure the correct stakeholders are seated at the table	

Table 6.3: The third step of ITG implementation at the Radboudumc

Step	Action			
Generating Support	*Why*	*What*	*Who*	*How*
	To decrease resistance to ITG	Generating support	Compliance & security officer	By involving the appropriate stakeholders
		Stakeholder	Action	
	To optimise ITG for the Radboudumc	Assist in the dev of ITG at the Radboudumc	All stakeholders	By sharing opinions, insights and knowledge
	Implementation Principle			
	Our employees work autonomously	*Measure twice, cut once*	*Communication is everything*	
	Find ways in which ITG aids the professionals	Include multiple stakeholders	Communicate the ways in which ITG aids professionals with the stakeholders	

Table 6.4: The fourth step of ITG implementation at the Radboudumc

Step	Action			
Exception process	*Why*	*What*	*Who*	*How*
	Employees at the Radboudumc work as autonomously as possible and exceptions must be possible	Exception process	Compliance & security officer	By developing a clear exception process
		Stakeholder	Action	
	To ensure that only those exceptions that need to be made, are made	Criteria for when an exception has to be possible	All stakeholders	Interview
	Implementation Principle			
	Our employees work autonomously	*Measure twice, cut once*	*Communication is everything*	
	The possibility of exceptions ensures maximal autonomy of employees	Interviewing multiple stakeholders before developing the process	The process is clear and all stakeholders are aware of how exceptions can be made	

Table 6.5: The fifth step of ITG implementation at the Radboudumc

Step	Action			
ISO 27001 Chapter 6	*Why*	*What*	*Who*	*How*
	To have roles and responsibilities defined and allocated	ISO 27001 Chapter 6	Compliance & security officer	The organisation lays out the roles and responsibilities for information security, and allocates them to individuals
		Stakeholder	Action	
	Have roles and responsibilities defined and allocated	Accept roles and take responsibilities	Those with a role in information security	By taking responsibility for one's role
	Implementation Principle			
	Our employees work autonomously	*Measure twice, cut once*	*Communication is everything*	
	Defining the roles and responsibilities without dictating how the individuals should work	Include multiple stakeholders before further action	Roles and responsibilities are clear to all involved in information security	

Table 6.6: The sixth step of ITG implementation at the Radboudumc

Step	Action			
ISO 27001 Ch. 5…15	*Why*	*What*	*Who*	*How*
	To get all the benefits from ISO 27001	ISO 27001 chapter 5…15	Compliance & security officer	Implementing ISO 27001 chapter 5, 7,8,9,10,11,12,13,14 and 15
		Stakeholder	Action	
	To get all the benefits from ISO 27001	Responsibilities defined in chapter 6 of ISO 27001	Those with a role in information security	By taking responsibility for one's role
	Implementation Principle			
	Our employees work autonomously	*Measure twice, cut once*	*Communication is everything*	
	The autonomous professionals at the Radboudumc are not hindered but rather supported	Include multiple stakeholders before further action	Results of the implementation and its effects are communicated throughout the Radboudumc	

Table 6.7: The seventh step of ITG implementation at the Radboudumc

Step	Action			
ISO 27001 certification	*Why*	*What*	*Who*	*How*
	To help research with grants and show the success of ITG	ISO 27001 Certification	Ext. Auditor and compliance & security officer	Audit
		Stakeholder	Action	
	Test the 'as is' situation with the ISO 27001 policies	Cooperate with and give guidance to the auditor	Mngmt team of the IT dep, compliance & security officer	Showing the auditor around and providing him with appropriate access
	Implementation Principle			
	Our employees work autonomously	*Measure twice, cut once*	*Communication is everything*	
	The audit does not interfere with the autonomy	Help measure progress and results	Communicate results and examples to departments	

Table 6.8The eight step of ITG implementation at the Radboudumc

Step	Action			
Start Cobit	*Why*	*What*	*Who*	*How*
	Continuing ITG implementation and taking the Radboudumc to a higher level	Start Cobit	Compliance & security officer	Tbd when ISO 27001 is implemented
		Stakeholder	Action	
	Continuing ITG implementation and taking the Radboudumc to a higher level	Tbd when ISO 27001 is implemented		
	Implementation Principle			
	Our employees work autonomously	*Measure twice, cut once*	*Communication is everything*	
	Tbd when ISO 27001 is implemented			

7. Conclusion

This chapter contains the conclusions of the research described in this thesis. The thesis started with a problem statement; the lack of a framework for IT governance in healthcare.

The main research question rephrased the problem statement:

"What is an appropriate IT Governance framework for the Radboudumc and how should it be implemented?"

We found that ISO 27001 is an appropriate IT Governance framework for the Radboudumc and should be implemented by starting with chapter 6 of the framework. We identified this framework and the way it should be implemented by answering four knowledge questions:

1. Which IT governance frameworks are available for the Radboudumc? (section 7.1)
2. What are the specific critical success factors for IT governance at the Radboudumc? (section 7.2)
3. What is an appropriate IT governance framework for the Radboudumc? (section 7.3)
4. How should an IT governance framework be implemented at the Radboudumc? (section 7.4)

To answer the main question this report has worked towards taking the first steps in ITG research in healthcare. We have done this by finding and selecting the appropriate ITG framework for the Radboudumc and developing implementation principles for ISO 27001 at the Radboudumc. We concluded with strategic information security policies that help prioritise the sections of ISO 27001, and stated that the Radboudumc should start by implementing the organisation of information security. This will in turn be the stepping stone for further implementation of ITG at the Radboudumc. The sections below briefly summarise the answers to these knowledge questions.

7.1 Available IT governance frameworks

The first sub-question is:

"Which IT governance frameworks are available for academic medical centres?"

The two IT governance frameworks that fit our definition of IT governance are ISO 27001 and COBIT. This thesis first looked at the available ITG frameworks. A literature review revealed that out of the many frameworks available, only two fit the definition of ITG as given by Weill (2004): "*IT Governance represents the framework for decision rights and accountabilities to encourage desirable behaviour of IT.*" If a framework does not satisfy this definition or is not available to the researcher, it is excluded from the study.

The two remaining frameworks are COBIT and ISO 27001. These frameworks have a different scope. COBIT focusses on all aspects of ITG. Its 34 processes and 318 control objectives cover ITG from planning and organising IT, acquiring and implementation, delivery and support to monitoring and evaluation. Because COBIT is extremely audit-oriented, it provides excellent checklists for various aspects of IT within organisations. One of the weaknesses of COBIT however, is that the COBIT framework is generic.

The second ITG framework, ISO 27001, only concerns information security. It therefore does not provide us with a framework for the whole ITG spectrum. However, combining ISO 27001 and COBIT seems logical to get the benefits from both worlds, the wider reference framework by COBIT and the more detailed guidelines provided by ISO 27001 for information security. The synergy of combining these two frameworks can be substantial.

7.2 Critical success factors in an academic medical centre

The second sub-question is:

"What are the specific critical success factors for IT governance at the Radboudumc?"

We have found 18 critical success factors for IT governance at the Radboudumc. The most mentioned of them are the need for guidelines and the shared understanding of business and IT. A combination of a literature review and expert interviews revealed all CSFs of IT Governance in an academic medical centre. The CSFs found consist both of CSFs and out of inhibitors.
Looking at the identified inhibitors it is clear that inhibitors can function as a CSF as well. By converting the inhibitors to CSFs we get one clear overview of the factors influencing ITG success in the organisation which helps us to not over-engineer the process.

Combining the CSFs from the research literature and the interviews gives us 18 CSFs. It is clear that, in both literature and the interviews, the need for guidelines and the shared understanding of business and IT are the most important CSFs. At the Radboudumc the need for guidelines and the shared understanding of business and IT can be seen in the fact that, according to the interviewees, Radboudumc does not excel at (general) governance, nor in enforcing policies. Defining and aligning IT and business strategies and stakeholder management follow closely. Since the decisions made by governance bodies are not always accepted it is of utmost importance to conduct good stakeholder management. One of the interviewees states that it is hard to get the right people a seat at the table. This is partly due to the fact that the Radboudumc consists of 52 financially independent departments. This results in 52 internal customers, all with different needs. This makes it hard to make decisions for the whole Radboudumc instead of for one department. Overall communication and balance of business and IT in IT decisions and senior management support are apparent CSFs as well.

7.3 Selection

The third sub-question is:

"What is an appropriate IT governance framework for the Radboudumc?"

We have identified ISO 27001 as an appropriate IT governance framework for the Radboudumc. Chapter 6 compared both frameworks, COBIT and ISO 27001, to the situation at the Radboudumc. The most appropriate framework enables the Radboudumc to start implementing successful ITG.

The COBIT framework is unknown by all except a few IT employees. ISO 27001 on the other hand gives more in-depth knowledge on information security. Especially in healthcare, information security has gained a lot of publicity during recent years.

Additionally, information security, specifically ISO 27001, can aid research at the Radboudumc directly. More often than not subsidies (grants) for research contain a specific criterion that states that the academic medical centre (or other body conducting the research) has to be ISO 27001 certified, to ensure information security is meeting standards.

A third aspect is how well known the framework is within the branch. ISO 27001 is best known due to its resemblance with NEN 7510 (the Dutch standard for information security in

healthcare). Due to the resemblance to NEN 7510, ISO 27001 is known by governmental policy makers and researchers alike, granting it more support.

Furthermore, we have found during the interviews that a 'big bang' approach would not work in the Radboudumc. ISO 27001 has a smaller scope and is therefore more applicable. It only spans information security, which can thus be used as the start for ITG at the Radboudumc. It is therefore clear that the most appropriate framework for ITG at the Radboudumc is ISO 27001.

7.4 Implementation

The fourth sub-question is:

"How should an IT governance framework be implemented at the Radboudumc?"

A roadmap for IT governance framework implementation has been develop for the Radboudumc. The first three steps include defining a baseline for ITG, including the appropriate stakeholders and generating support for ITG. We then advise to start with chapter 6 of ISO 27001 as this lays out the roles and responsibilities for information security.

We developed three implementation principles for the Radboudumc, based on their specific situation. The next steps are then

(1) Define a baseline for ITG by means of a mock ISO 27001 audit.
(2) Conduct a stakeholder analysis to include the right
(3) Include the stakeholders in the implementation and development of ITG at the Radboudumc and generate support for ITG.

Steps one and two are simultaneous while step three can only be completed after the first two steps. Generating support is done by involving the stakeholders and finding examples of how ITG can benefit the Radboudumc in general and care providers specifically.

Since the employees at the Radboudumc work as autonomously as possible and it is a desire to be able to deviate from regular ITG processes and policies, exceptions must be possible. To ensure that only those exceptions that need to be made, are made, a process is necessary. If there would be no process, in which all the appropriate stakeholders have a role, more exceptions then regular policies could be the result.

We then argue that, even though all chapters of ISO 27001 have to be implemented, the Radboudumc should start with chapter 6; organisation of information security. This chapter makes sure that the organisation lays out the roles and responsibilities for information security management, and allocates them to individuals. Defining the roles and responsibilities before developing the policies ensures that the correct stakeholders can be involved from the start. This in turn helps to see the policies not as restricting the freedom of the employees but rather as enabling them to deliver better and safer work.

Furthermore, having the right stakeholders involved from the beginning onwards will help when defining a process for specific exceptions and help communication of the policies.

In co-operation with the security officer of the Radboudumc we have developed strategic information security policies (in Dutch), starting with the organisation of information security.

After successful implementation of ISO 27001 the Radboudumc should achieve certification. This will measure the success of the implementation and help more research to be (as ISO 27001 certification is a criterion that is more and more common). The final step of the roadmap is the start of Cobit. As stated in this research Cobit has a much broader scope (the whole of IT instead of only information security). This will help the Radboudumc to truly take ITG and the department as a whole, to the next level of professionality.

8. Discussion

Validation interviews with experts at the Radboudumc have shown the value of this research. This research contributes to the understanding of IT governance in healthcare. Some limitations apply and there is plenty of room for further research in this area.

8.1 Contribution

This research takes a first step towards putting flesh on the bones of ITG in healthcare. Much has been written about how ITG can, theoretically, bring benefits to the healthcare domain. Yet there are no examples of success nor is there any research into how this can be achieved in a complex environment such as an academic medical centre. We propose a framework and a roadmap to do so.

The first input was reviewing existing literature. After this review, which is described in chapter 4, it was clear which ITG frameworks are available to healthcare. However, most ITG frameworks were omitted because they did not satisfy Weill's (2004) definition of ITG. This is due to the fact that there are multiple definitions of IT. We adopted the definition most used in the academic world while the business focusses more on managing performance and creating value.

This thesis continues by investigating the healthcare context with another literature review and expert interviews, which are described in chapter 5. This thesis gives an overview of the CSFs of ITG for the healthcare domain specifically, and provides concrete examples of how these categories translate into the specific context of an academic medical centre. The CFSs were taken from literature and validated through interviews with experts and together this provides a thorough understanding of not only the CSFs but also the healthcare specific needs when tailoring ITG to the needs of practitioners. The context specific issues provide other academic medical centres and hospitals with a reference guide.

Furthermore, given the context of an academic medical centre, this thesis provides practitioners with implementation principles and a starting point for ITG implementation. Since this thesis proposes the generic CSFs, context specific issues, generic implementation principles with context specific examples and a context specific approach to implementing ITG it provides both, a generic starting point for organisations in a complex environment to start with ITG and a specific approach of how academic medical centres, in specific the Radboudumc, can implement ITG.

The main contribution of this thesis is that we propose concrete first steps as to how ITG can be implemented in a complex environment such as an academic medical hospital. Thereby putting flesh on the bone of ITG research in healthcare and simultaneously providing practitioners with a helping hand on how to put ITG on the agenda and start with its implementation.

In addition, this thesis has gathered all of the available literature on ITG in the healthcare domain, and collected from it the frameworks and critical success factors. It then provides concrete examples of how the generic CSFs from literature translate to specific issues in the context of the Radboudumc.

Further research should build in these contributions. The last section of this chapter includes proposals for how.

8.2 Generalisation

This research proposes implementation principles and a roadmap for ITG implementation in an academic medical centre. These principles and the roadmap can however be used by more organisations than the Radboudumc.

First of all other academic medical centres have a similar environment and they can therefore directly adopt the implementation principles. Even though the roadmap is tailored to

the Radboudumc, other academic medical centres can benefit from it as well. The first four steps; defining a baseline, conducting a stakeholder analysis, generating support and developing an exception process are vital for every academic medical centre. To convince employees and management alike, it is vital to understand the current state of ITG as well as what successes it brings. Having the appropriate people seated at the table will ensure that progress can be made and that not every answer will be the start of another discussion. Whether the proposed framework is suitable for every academic medical centre is a more complex question. Some academic medical centres may have already started with another framework. In that case the momentum from that framework should be used to start ITG implementation, however academic medical centres have to keep in mind that starting small and measuring success are key to a successful implementation.

Looking at other organisations where the proposed ITG implementation principles and the ITG implementation roadmap can be used (general) hospitals and universities come to mind. They are contextually similar to academic medical centres in numerous ways but their differences develop the need for a revision of the principles and roadmap. Concerning (general) hospitals, the autonomy of the employees is not always as important as in an academic medical centres. Doctors may be salaried and more likely to adopt policies from management. In universities the autonomy of the employee is similar to the autonomy at an academic medical centre but it may prove less opportune use ISO 27001 as a framework. Patient safety (including data) is very important for employees at an academic medical centre where the safety of a student's data might not prove to be as important to all employees at a university. None the less, ISO 27001 can provide universities with an opportunity to implement ITG while still starting small.

The third group of organisations to whom the implementation principles and the implementation roadmap can be of use are all professional bureaucracies. The autonomy of the employee is vital at each of these organisations, just as communication and measuring success will be. The appropriateness of the framework will have to be revisited since multiple of the underlying assumptions and reasons for choosing ISO 27001 might not apply in these organisations.

8.3 Limitations & future work

One of the major limitations of this work is that the guidelines have only been validated by expert interviews. In the future, this should be combined with action research, however, due to the limited time frame of this thesis, this was not possible. Validation by expert interview does give us insight into how expert think ITG should be implemented in an academic hospital but this may prove to differ from reality.

Finally, in order to simplify the relations, an abstraction of the inhibitors has been made to convert them to CSFs. In this conversion some information is lost due to the fact that not every inhibitor gets its own CSF. For example, 'inadequate organisational cultures', 'Inadequate support for financial resources' and 'inadequate support for time resources' are all converted to the CSF 'change management'.

For future research it is important to state that this thesis only provides a stepping stone for ITG in healthcare. After case validation at multiple hospitals, research should focus on two aspects.

The first aspect is the benefits that ITG can bring to the healthcare domain. Current literature fails to provide anything more than general benefits. This is logical since ITG in the healthcare domain is not mature. With multiple hospitals adopting ITG this situation changes and researchers can finally provide specific benefits of ITG (or they may find that ITG was a waste of time and effort after all). This research may also show differences between academic medical centres and peripheral hospitals, which can in turn lead to different implementations of ITG.

The second aspect of future research is the continuous process of ITG. After providing the healthcare sector with a starting point for ITG, they will need guidance as to how ITG should be implemented and adopted. ITG can not be set and forgotten but rather need continuous improvement and guidance. There are currently no healthcare specific processes that aid in this process, nor are there examples of adaptations of industrial processes to the healthcare domain. To fully utilise the benefits of ITG, the continuous process is vital and therefore requires further research.

Combining the two aspects of future research combined with case validation at multiple hospitals will provide the healthcare sector and researcher with an opportunity to tailor ITG to the healthcare sector and provide healthcare with the benefits that it needs. During the coming years heath care will become more and more IT dependent and ITG will become more and more important to ensure a good synergy between IT and the hospital itself. Good ITG in healthcare will therefore not only benefit researcher and practitioners but, eventually, even the patients.

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Appendix A – Interviewees

A comprehensive list of all interviewees at the Radboudumc:

- IT program manager
- Compliance & security officer
- Internal auditor
- Head of department
- Two servicemanagers
- Project portfolio manager
- Financial IT advisor
- Information manager
- Chief business information officer
- Chief nursing information officer
- CIO
- Enterprise architect
- Board member

Appendix B – Critical success factors from the interviews

Stakeholder Management

- De juiste mensen om tafel krijgen is binnen het Radboudumc lasting
- De management laag binnen het Radboudumc moet mee gaan in ITG
- 'De klant' bestaat niet, 52 resultaatafhankelijke afdelingen levert 52 klanten op
- Wie te betrekken? Iedereen wil meepraten
- Top-down werkt hier niet, je moet je plek verdienen en de juiste mensen betrekken

Senior Management Support

- ITG als opdracht vanuit de Raad van Bestuur de organisatie in, dit zorgt voor draagvlak
- ITG en governance leven nog niet bij de Raad van Bestuur
- Draagvlak, gezag (h)erkennen
- Geen awareness, ook niet bij de Raad van Bestuur
- Daadkracht nodig vanuit de Raad van Bestuur
- Controle op naleving beleid vanuit Raad van Bestuur noodzakelijk

Change Management

- Borgen van ITG is een grote uitdaging voor het Radboudumc

Cultuur

- Autonome professional is gewend om zijn eigen beslissingen te maken over alles. Dit levert een extra uitdaging op.
- Autonome professional die de meerwaarde van ITG en de hier bij horende gremia pas op de lange termijn kan zien maakt zulke trajecten extra lastig
- Eigenaarschap is nog niet altijd even goed belegd binnen het Radboudumc
- Geen aanspreekcultuur op plichten en verantwoordelijkheden
- Verbetering 'ongoing concern' vindt nog te weinig plaats doordat hier weinig aandacht voor is
- Eigenaarschap is diffuus binnen het Radboudumc
- Zeer hoge mate van autonomie van de professional
- Gezag gremia (h)erkennen is niet vanzelfsprekend
- Autonome professionals zijn gewend hun eigen gang te gaan maar denken voor hun eigen specialisme en niet Radboud breed.
- Wie te betrekken? Iedereen wil meepraten
- Je moet je plek hier verdienen gezag wordt niet zomaar (h)erkend
- Raad van Bestuur is niet richtinggevend genoeg, autonomie van professionals is zeer hoog

Mitigation of risk

- Door middel van transparantie kunnen incidenten sneller worden verholpen
- Nu weten we pas welke risicos we lopen als het mis gaat

Communicatie

- Meerdere initiatieven lopen maar dit is niet voor iedereen helder
- Verschillende initiatieven maar onderscheid mist
- IM werkt klantvraaggericht maar de strategische relaties zijn onduidelijkl
- Gremia en de samenhang hiervan moet uitgedragen worden, deze is onduidelijk
- Processen rondom ITG staan maar er is weinig sturing en controle. Hierdoor is het niet voor iedereen even helder.
- Wat is de behoefte van het huis? Hoe haal je deze op? Wat loopt er binnen IM?
- Veel is al geregeld maar dit is nog niet bij iedereen even duidelijk (HR voorbeeld)

Not overengineering the process

- Voldoende vrijheid laten voor de autonome professionals
- Zorgprofessional niet hinderen maar ondersteunen bij zijn proces
- ITG moet een goed passende jas zijn en niet beknellend
- Niet oeverloos discussiëren maar ook besluiten kunnen doorzetten

Strategie

- IM werkt klantvraaggericht maar de strategische relaties zijn onduidelijk

Balans business in IT beslissingen

- De business heft onvoldoende inbreng op het IT programma

Leiderschap IM

- Leren om nee te zeggen

IT provides efficient and reliable services to user departments

- IM kan niet al haar afspraken waarmaken wat afbreuk doet aan het imago en recht van spreken van IM.

Appendix C – Inhibitors from the interviews

Inadequate stakeholder management

- IT governance ziet er goed uit maar wie het daadwerkelijk gaat implementeren en borgen is een lastige vraag. Het beantwoorden van deze vraag is niet iets waar wij als Radboudumc goed in zijn.
- ITG zit niet in de genen van een medewerker omdat het veelal ver weg staat van zijn primaire taak. Dit maakt het lastig om draagvlak te creëren.
- Het Radboudumc moet nu beginnen met ITG, maar hier moet sterk rekening gehouden worden met de autonome professionals. Het Radboudumc is een professionele bureaucratie wat al aangeeft dat ITG niet ingericht dient te worden vanuit een IT perspectief want dan loop je tegen heel veel weerstand aan.
- De vraag is wel; Wie betrek je erbij? Dat is in een organisatie als deze heel erg ingewikkeld.
- De juiste stakeholders betrekken is cruciaal. Iemand naar een overleg sturen en dan de besluiten daarvan accepteren is in het Radboudumc niet meer aan de orde. Iedereen wil overal over meepraten wat enorm vertraagd.
- Er zijn veel belanghebbenden die ook meegenomen moeten worden.

Lack of clear ITG principles

- Binnen IM zijn we nog niet zo ver dat we werken conform een governance. Bij security werken we aan de inbedding van een raamwerk, maar ook hier moeten nog een aantal stappen genomen worden.
- Afdelingen zijn leidinggevend en dienen beleid uit te voeren. Wel blijkt dat er weinig beleid gevormd is en dat het beleid wat er is niet gehandhaafd wordt.

Inadequate organisational cultures

- Het risico zit ook in de artsen zelf. Autonome professionals die gewend zijn om hun eigen beslissingen te maken krijg je moeilijk in een IT governance structuur.
- ITG leeft nog niet bij de raad van bestuur. Dat dit wel gaat leven bij de raad van bestuur is essentieel omdat er draagvlak nodig is om ITG te kunnen borgen.
- Eigenaarschap is iets waar het Radboudumc nog veel kan winnen, dit is nog altijd niet even duidelijk geregeld.
- De dokters zijn gewend op een bepaalde manier te werken en hier moet als ITG niet doorheen gegaan worden. ITG, op een slimme manier, is goed voor het Radboudumc want dan gaan dingen handig en goed aangezien het ingebakken zit in de organisatie.
- Binnen het Radboudumc is het altijd heel lastig geweest om governance goed georganiseerd te krijgen. Een belangrijke oorzaak hiervan is dat het eigenaarschap van bijvoorbeeld systemen altijd diffuus geweest is.
- Doordat we allemaal verantwoordelijk zijn is niemand eindverantwoordelijk.
- De diffusiteit van de organisatie en de autonome cultuur van de specialist maken het erg lastig om ITG juist te implementeren.
- Het Radboudumc is heel goed in hokjes denken. Er heerst een afschuifcultuur (over het hekje gooien). i.p.v. samen een goede oplossing bedenken.
- Het is lastig om de autonome professional mee te krijgen, hier moet wel op ingespeeld worden. De professionals moeten ook leren om in het belang van het Radboudumc te denken in plaats van het eigen belang.
- De grootste drempels zijn van culturele aard. Nu is elk besluit het begin van de discussie en dit kan niet meer zo blijven.
- De awareness is er nog niet, ook niet bij de raad van bestuur.

Lack of communication

- De belangrijkste drempel voor ITG implementatie is het in zeer eenvoudige termen duidelijke moeten kunnen maken wat ITG doet en oplevert om mensen mee te krijgen.
- Lopende activiteiten ('going concern') zoals changes hebben momenteel nog geen enkele vorm van governance. Er lopen activiteiten maar deze zijn slecht zichtbaar.
- Ook communicatie is een uitdaging. Hoe krijgt IT een goed beeld van de behoefte van de afdelingen en hoe komt IT zo tot een goed programma?

Lack of clear ITG processes

- Het beslismodel is niet toereikend, er is weinig centraal beleid en nog minder controle hierop. Veel afdelingen handhaven een eigen interpretatie van het beleid.
- Wie formeel een beslissing moet nemen is niet altijd duidelijk. Pietje van afdeling A zegt X en Jantje van afdeling B zegt Y. Top down dan een besluit door proberen te voeren werkt niet binnen het Radboudumc.
- IM en het huis zijn vaak twee verschillende werelden. Er zijn initiatieven die echt de verbinding met het huis proberen te maken maar het huis begrijpt nog onvoldoende hoe strategisch belangrijk IM is en IM begrijpt nog onvoldoende hoe belangrijk het huis is. Hierdoor sluiten de processen niet altijd voldoende aan.
- De zorgprofessional moet ondersteund worden en niet worden gehinderd in zijn proces.
- Voor IM geldt dat (beheer, incidenten en non standard changes) ze de eigen governance nog niet goed op orde hebben. Er is een proces maar nog geen sturing en controle.

Inadequate support for financial and time resources

- ITG gremia moeten een blik breder hebben dan hun specialisme. De werkzaamheden van de gremia dienen zichtbaar en meetbaar te zijn voor het huis en hier gaat tijd overheen.

The benefits of ITG in the healthcare domain

Teerenstra, G

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Abstract

This paper presents a literature review of how ITG can benefit the healthcare domain. We have performed a structured literature review and classified our results using a CIMO-analysis. We found that important benefits can be achieved in the healthcare domain but that budgets are low and misspent. At the same time ITG does not get the top management commitment that it needs. The CIMO-analysis illustrated that in a context characterised by high political, organisational and public pressures, cost pressures, different levels of IT competency and certain organisational cultures, in order to improve the ITG benefits, governance structures and processes should be adopted, a quality and continuous improvement methodology should be adopted, business rules to provide support at the right level of governance should be developed, risk management should be conducted, resource management should be adopted and educational programs should be developed. The interventions, as well as the benefits, are very generic and insights into how the proposed benefits can be achieved in the healthcare domain specifically are currently absent.

1. Introduction

Governance is "defining and realizing missions and goals, establishing strategic direction, policies and objectives to that end, and monitoring implementation" (McNally, 2003). Information Technology Governance (ITG) parallels corporate governance in that it also refers to the patterns of authority over Information Technology (IT) resources and the means for integrating IT interests (McGinnis, Pumphrey, Trimmer, & Wiggins, 2004). Another definition of ITG is that it is a subclass discipline of corporate governance that concentrates on information technology systems, business operations, and risk management (Saetang & Haider, 2013). The most commonly accepted definition of IT governance is: "*IT Governance represents the framework for decision rights and accountabilities to encourage desirable behaviour of IT*" (Weill, 2004). Weill extends this definition by providing a contrast to IT Management: "*IT Governance is not about what specific decisions are made. That is management. Rather, governance is about systematically determining who makes each type of decision (a decision right), who has input to the decision (an input right) and how these people (or groups) are held accountable for their role. Good IT Governance draws on corporate governance principles to manage and use IT to achieve corporate performance goals.*"

In the industry domain it is widely accepted that IT Governance directly influences the benefits generated by organisational IT investment (Lutchen & collins, 2005; Weill, 2004). It is not surprising then that IT Governance in businesses, has emerged as an important area of enquiry of academics and practitioners alike. Academic papers that use the term IT Governance in the title of the paper began to occur as far back as 1990 (Webb, Pollard, & Ridley, 2006).

One of the key issues in IT management during the last decades has been the alignment of business and IT (Luftman, 2005; Niederman, 1991). Unfortunately, the healthcare industry has fallen behind in their adoption of IT (Lutchen & Collins, 2005). Establishing IT governance in the healthcare domain can solve this problem (Lutchen & Collins, 2005), but insufficient implementation of IT governance can lead to misalignment of business and IT, a lower return on assets (ROA) and failure of IT investments (Weill & Ross, 2004).

Much is known about ITG in the private sector but this is not the case for the healthcare domain. There are big differences between the private sector and the public sector concerning ITG

(Sethibe, Campbell, & McDonald, 2007). Additionally, Sethibe et al. found that a 'one-size-fits-all' approach is not appropriate when studying the two sectors. Failure to address this will be 'a mistake' when studying ITG (Khalfan & Gough, 2002).

Most healthcare organisations in the Netherlands are not-for-profit organisations and have a professional organisational structure (Eeckloo, Delesie, & Vleugels, 2007). These characteristics demand IT governance that differs from other organisations in other domains, for example for-profit organisations with a diversified structure (Weill, 2004). The (Dutch) healthcare domain is a sensible domain for ITG. For example, the recent implementations of electronic patient records put higher demands on IT in the healthcare domain. This requires organisations to share information with external sources, which in turn requires that the healthcare organisations have organised their information processes in such an orderly fashion that they possess the ability to export information outside of the organisation (Trans-institutional healthcare organisations (Winter et al., 2010). Therefore, the question that this study will try to answer is:

"*How can the healthcare domain benefit from IT governance?*"

In this study we present a systematic review of the evidence regarding the effectiveness of ITG in the healthcare domain. With the goal of researching not only the benefits of ITG in the healthcare domain, but equally important, the cause and effect relationship chains between them, and in order to maximise the richness and depth of the analysis of the evidence, we apply the design-oriented research synthesis method proposed by Denyer et al. (2008). Using this method, we extract design propositions in the lines of the Context Intervention Mechanism Outcome (CIMO) logic. Denyer et al. see a design proposition as offering a general template for creating solutions for a specific class of problems.

In section 2 we describe the literature review methodology. In section 3 the findings of the review are presented, starting with the state of the art of ITG in the healthcare domain, followed by a review in terms of Context, Mechanism, Intervention and Outcome elements as well as by applying a model, the IT Governance Benefits Map (ITGBM), for documenting, structuring and making sense of the outcomes. In section 4 the findings are discussed, their implications and we propose future research. The paper is concluded in section 5.

2. Methodology

For the literature the Systematic Literature Review (SLR) methodology of Tranfield, Denyer and Smart (2003) will be used. Tranfield et al. (2003) propose a methodology for conducting SLRs pertinent to the management research domain by transposing relevant, established and highly influential methodologies from the medical research domain. The rationale for adopting such a highly structured and systematic methodology lies in maximising rigour, minimising bias, and enhancing the traceability and reproducibility of the results (Boucharas, van Steenbergen, Jansen, & Brinkkemper, 2010).

The SLR methodology of Tranfield et al. (2003) consist of three main stages. The first stage concerns the planning of the SLR. This stage is broken down into three phases; Identification of the need for a review, preparation of a proposal for a review, and the development of a review protocol (keywords list). The final result of this phase is a review protocol that may contain a conceptual discussion of the research problem and a statement of the research problem. Furthermore, literature reviews are regarded as a process of exploration, discovery and development. The review protocol may therefore contain explicit goals *a priori* but can be modified. The goal is to produce a protocol that does not comprise the researcher's ability to be creative whilst ensuring reviews be less open to researcher bias.

The second stage regards conducting the actual review. This stage contains five phases; identification of research, selection of studies, study quality assessment, data extraction and monitoring progress and data synthesis. This stage starts with the identification of keywords and search terms built from the scoping study (conducted during phase 1), literature and discussion

with the review team. Subsequently the most important search strings are chosen. At the same time the inclusion and exclusion criteria for the study are determined to include the appropriate papers. The quality assessment conducted during this stage concerns the appraisal of the study's internal validity and the degree to which its design, conduct and analysis have minimised biases and errors.

The third and final stage of the SLR involves the reporting and dissemination. Stage three consists of two phases; the report and recommendations and getting evidence into practice. In this stage a rough cut 'descriptive analysis' of the field is realised, using questions such as; "Who are the authors?", "What is the country of origin of the included studies?", and "What is the age profile of the included studies?" This is followed by a 'thematic analysis' which in this case includes the state of the art of ITG in the healthcare domain and a design oriented research synthesis.

In order to maximise the richness and depth of analysis of the evidence, the design oriented research synthesis method as proposed by Denyer (Denyer et al., 2008) will be used. Using this method Context Intervention Mechanism Outcome (CIMO) logic will be used to extract design propositions. Denyer et al. see a design proposition as offering a general template for creating solutions for a specific class of problems. A design made up of CIMO-logic components is formed as follows: for some problematic Context(s), use some specific Intervention(s) that will invoke some generative Mechanism(s) that in turn will deliver the desired Outcome(s). Design propositions thus not only inform on what to do in a specific situation in order to create a specific effect but more importantly, they offer some insight on why it happens. Adjusting the CIMO-logic to this study, we extracted and synthesised data in the following categories:

(C) context for which ITG in the healthcare domain has been found of value,
(I) interventions that are included in ITG,
(M) mechanisms that answer how or why ITG produces or contributes, directly or indirectly, to certain organisational outcomes, and
(O) organisational outcomes — results of the application of ITG in the healthcare domain (alternatively referred to as ITG Benefits).

It is important to note that CIMO relationships do not necessarily reflect causal relationships. A relationship between a Context (C) and the Intervention (I) suggests that ITG has been found to be of value in the specific Context (C). A relation between the Intervention (I) and a Mechanism (M) suggests that ITG has been found to invoke or realise the specific Mechanism (M) . A relation between an Intervention (I) or a Mechanism (M) and Outcome (O) suggests a cause and effect relationship between them.

Keywords, In- and Exclusion Criteria

The initial keywords were "IT Governance Benefits" AND "Healthcare". This query returned only six useful papers own Google Scholar. We therefore broadened the search to include all the keywords listed in appendix A. This extensive list was generated by conducting an unstructured search to develop an understanding of the field, the key words identifying the studies found were thereafter used in the SLR.

The inclusion criteria are:

- Studies whose main topic is IT Governance in the healthcare domain.
- Studies whose main topic is the differences concerning IT Governance in the private and public domains (e.g. private corporation vs. semi-governmental institution).

If a paper does not confirm one of these criteria, it is removed from the results.

The exclusion criteria are defined as follows:

- Studies that are reported several times (only the most recent study is included).
- Papers that are not accessible through the libraries of the University of Twente or the Radboud University Nijmegen.
- Studies that focus on IT Governance outside the healthcare domain.

• Studies that focus on IT Governance benefits outside the healthcare domain.
If a papers conforms to one of the criteria, it is removed from the results.

The following search engines were searched: Google Scholar, Scopus, Web of Science, PubMed and Science Direct. Judging by the title and abstract we found 63 contributions. Additionally, two types of criteria for considering studies for this review were developed. Eligible study types were considered to be quantitative, qualitative, and mixed- method scholarly research and gray literature (i.e. literature that has not been refereed) in an effort to capture the broadest possible definitions of ITG benefits. Inclusion of gray literature to systematic reviews is considered to be advantageous in order to help minimise publication bias effects (Hopewell, McDonald, Clarke, & Egger, 2007). For qualitatively evaluating the studies every contribution was judged based on its "fit for purpose" (Boaz, Ashby, & Council, 2003), whether it added anything important to our understanding of the phenomenon under review (Pawson, 2002), and on its quality as it was established in relation to the rest of the contributions of the synthesis (Pawson, Greenhalgh, Harvey, & Walshe, 2005).

During the full text review 35 studies were found to be irrelevant to the synthesis. The remaining 25 studies were included in the synthesis. A full overview of the papers included in the study can be found in Appendix B.

We extracted 62 CIMO elements and 32 CIMO relationships. Next, we merged those CIMO elements that were deemed to be semantically equivalent in order to create a list of unique CIMO elements. After the merge, in total 39 unique CIMO elements and 26 unique CIMO elements relationships remained.

3. Results

First, a classification of the results will be presented. Second, an overview of the current state of ITG in the healthcare domain, as identified in the studies, is presented. Third, the context themes identified in the included studies are presented. Where they exist, the relationships of the contexts with other elements (i.a. ITG, ITG Mechanisms, and Outcomes) are described in-text. Then the ITG Mechanisms identified in the included studies are given and their relationships are described. Finally, a graphical overview is presented of the Outcomes and some Relationships, as identified in the included studies.

Classification of the results

We classified the 25 resulting papers using a number of methods: by country (of the author(s)), year and document type.

In order to get a quick overview of the results they are analysed by country of origin (figure 1), year of publication (figure 2) and type of documentation (figure 3). From figure 1 it becomes clear that most authors come from the United States, Germany, Australia and Switzerland. These countries account for 19 of the 30 contributing authors in the results. Interesting is thus that most contributions originate from western Europe and the United States. Even though the healthcare domain between western Europe and the United States are very distinct, the way hospitals are run are not that different. An example of this is that many western European hospitals use EMR systems from the United States.

Figure 2 shows how the results vary by year of publication. The earliest publications result from 2002. Since 2009 (with the exceptions of 2012 and 2014) multiple publications can be found per year with the most publications (8) in 2011. The figure looks like the start of a hype cycle (Gartner, 2016) which explains the high number of contributions during 2011, when expectations rose, and the drop after 2011 (the peak of inflated expectations).

Figure 3 shows the type of publications that we found. About half of the results were published on a conference and 36% came from journals. It is interesting to see that the search yields two dissertations, a doctoral one and one master's thesis. Additionally, only two non-refereed publications are included in the study even though our aim was to include gray literature in the study.

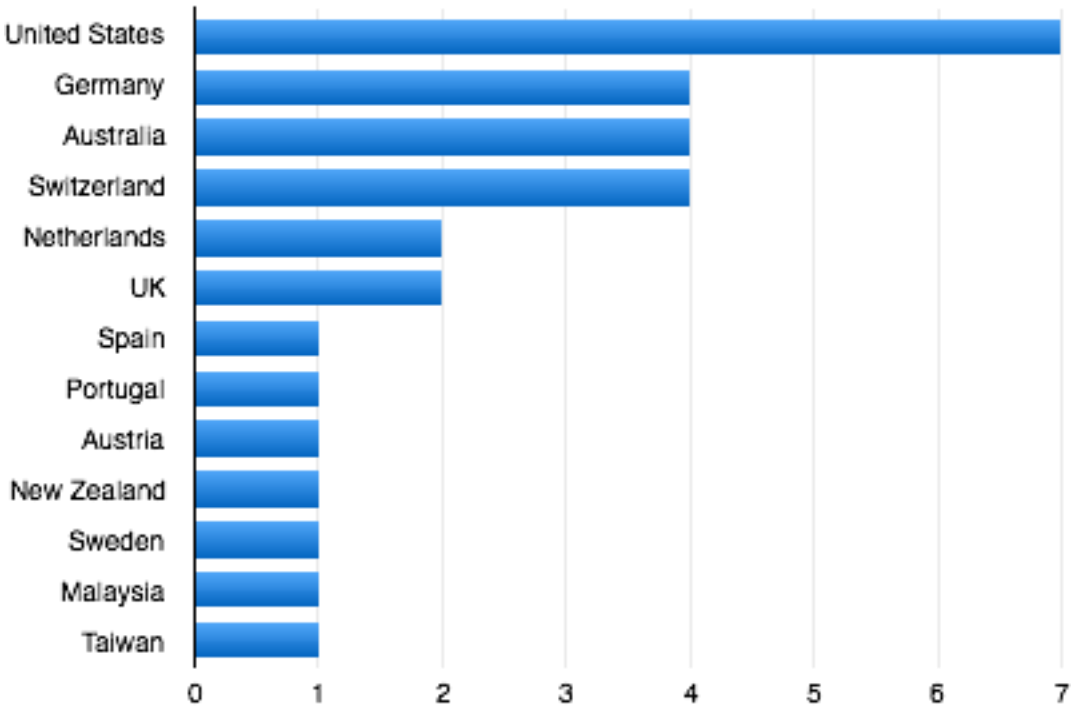
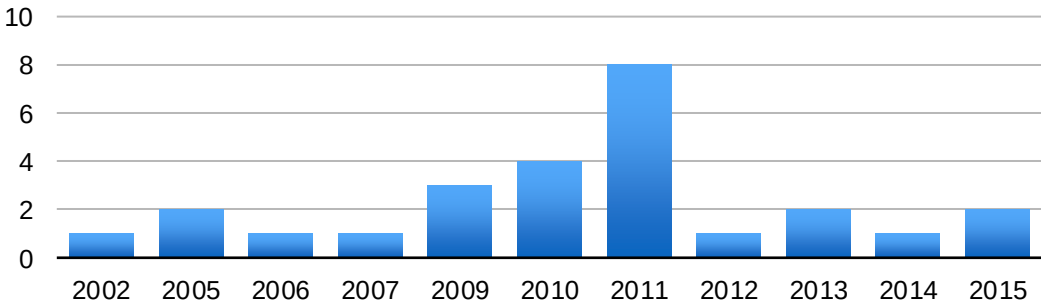


Figure 1: Results by Country
Figure 2: Results by Year



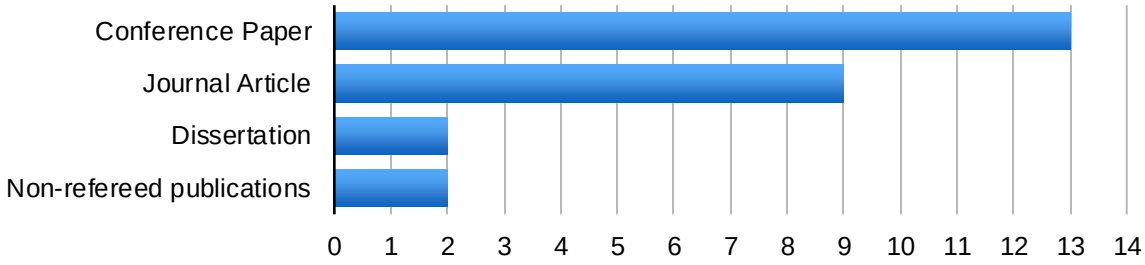


Figure 3: Results by document type

Current state of IT Governance in the healthcare domain

Potential value. Multiple papers found that getting IT right this time will not be about technology but about governing IT (Lutchen & Collins, 2005; Peterson, Parker, Ribbers, Peterson, & Parker, 2002). There are great benefits for ITG to be achieved in the healthcare sector, such as reducing complexity and aiding in the complexity of the medical profession by providing the right information promptly, stakeholder acceptance and prioritisation of critical demands and organisations-wide information management (Mike Krey, 2015). Furthermore IT governance can align Business and IT, prioritise IT investments, deploy IT, sustain strategic and tactical direction and sustain the value proposition of IT (Mike Krey, Furnell, Harriehausen, & Knoll, 2012). IT Governance is the responsibility of the board of directors and an integral part of corporate governance (Mike Krey, Harriehausen, Knoll, & Furnell, 2010; Zutschi et al., 2010). IT Governance should therefore be viewed as how IT creates value that fits into the overall corporate governance strategy of the hospital, and not as a discipline on its own (Mike Krey et al., 2010). Krey (2010) found that in 43% of the Swiss hospitals in the study, IT is featured 'occasionally' on the board's agenda and that business/IT alignment is lacking in the decision making and prioritisation processes. Research shows that the higher the ITG maturity in healthcare organisations, the lower the IT budget per adjusted patient day .

Management view. Hospital IT budgets are dominated by IT operations while innovation (IT Projects) represent the smallest area of the IT Budget (Köbler, Faehling, Leimeister, & Krcmar, 2009). Furthermore, IT Governance assessment tools were seen by the board as a 'tool' for further investment and nothing more (Lapão, 2011). This view of IT Governance seems to be widely adopted in the healthcare sector (Hoerbst, Hackl, Blomer, & Ammenwerth, 2011). Herbst et al. (2011) found that only 59% of the hospitals in their study has a working IT strategy and that the annual IT budget is below 2% of the total. The study also showed that only 18% of the hospitals had an IT service catalogue, which helps explain why IT is not widely recognised as a service provider yet. Rather IT is still seen as a technology provider (Hoerbst et al., 2011). The study by Krey et al. (2010) further showed that 83% of the private hospitals in Switzerland feature IT regularly on the board's agenda but no-one can challenge the CIO due to a lack of knowledge. This shows the need for business managers to understand IT Governance arrangements because otherwise the risk of misalignment occurs which in turn explains the lack of IT strategy committees and the failure to use IT as a strategic asset (Mike Krey et al., 2010).

As a result, the healthcare domain is lagging behind in the adoption of IT governance and losing money (Lutchen & Collins, 2005). Despite the fact that IT governance is crucial for every firm chasing for return on investment (Aasi, Rusu, & Han, 2014), a longitudinal study by Krey (2015) showed that IT Governance principles are still less marked in hospitals today because of four main reasons. In hospitals:

- There is a lack of expertise of the subject of IT Governance, Risk and Compliance
- There is a lack of resources that is committed to IT Governance, Risk and Compliance.
- There is a lack of motivation for IT Governance, Risk and Compliance
- There is much uncertainty under executives with regard to the reputation of IT.

Furthermore, in a hospital located in Asia, but managed by US and European managers, it was found that people saw IT Governance as 'running, planning, shaping and controlling IT capabilities in accordance with broad organisational strategy' (Saetang & Haider, 2013). This implies that the correspondents did not understand the true meaning of IT Governance and the results indicate this as well. The hospital had a poor business/IT alignment but it was understood that IT Governance delivered value (in the form of money savings, higher processing speeds and less workers needed).

Unique domain. Even though IT governance has transformed from a 'nice to have' into a 'must have' (Bonney, 2011), IT adoption rates are relatively low. While there is significant potential value to be derived from the adoption of IT Governance in which and these factors are unique for the healthcare domain (Thatcher, 2013). Healthcare is a complex and heterogenous economic sector and cannot be compared to industries where COBIT and other IT Governance frameworks have been successfully applied (Mike Krey et al., 2010).

IT Governance is not a 'one size fits all' subject and there is still very little research into IT Governance in the healthcare domain. IT managers in larger hospitals (in number of beds) are more likely to have decision authority on IT and IT architecture (Köbler et al., 2009; Köbler, Fähling, Krcmar, & Leimeister, 2010). In private hospitals, the highest IT budgets and proportion of IT projects in the budget can be found. IT managers in private hospitals are more likely to be dedicated to projects with a high return on investment. However project-oriented specification of business needs for IT applications is not conducted in a systematic IT Governance approach. This high absence rate is very surprising as IT project related budgeting is invested to develop novel IT solutions and drive innovation (Köbler et al., 2009; Köbler et al., 2010). In acute healthcare there are five major factors driving IT (Thatcher, 2013):

- The move from handcrafting knowledge to networking knowledge
- Increasing cost pressures and growing demand for services
- Advances in IT
- Improved IT literacy of staff
- A move from submissive patients to demanding customer

For the successful adoption of IT Thatcher (2013) found three relevant dimensions:

- Effects on quality of care
- Effects on efficiency
- Effects on cost

IT adoption increases adherence to guideline or protocol based care, reduces adverse drug events and it reduces serious medication errors. The effects on efficiency are most apparent in the decrease in utilisation rates of potentially redundant or inappropriate care, primarily associated with laboratory and radiology testing. Regarding the effects on cost the results were not so clear (Thatcher, 2013). Healthcare institutions in rural settings specifically face another challenge. In rural healthcare facilities there are many 'ad hoc' decision made without any 'real' IT Governance in place which allows for bad investments to be made (Wiggins, Beachboard, Trimmer, & Pumphrey, 2006).

Adapting to the Dutch healthcare domain. In an attempt to validate an IT Governance Maturity assessment method for (Dutch) hospitals Gordijn (2011) adapted the model by Cigref (2007) by adjusting the weightings. Gordijn found that, in the Dutch healthcare domain, leadership is more important because managers have to deal with professionals involved in the decision making process since hospitals are professional organisations (Mintzberg, 1989). Compliance is less important when assessing IT Governance Maturity in healthcare according to the correspondents of his study. Gordijn also showed that the Dutch hospitals differ from the Swiss ones from Krey's study (2010). Gordijn states that Dutch hospitals are more likely to base their IT Governance

approach on a frame of reference (such as COBIT) and that they have a slightly better business/IT alignment. Dutch hospitals do not seem to measure performance with Service Level Agreements (SLAs), user satisfaction or even business losses which occurred due to downtime.

Contexts for which ITG has been found to be of value

One of the key features of context extracted from literature is the *high political, organisational and public pressures* on healthcare institutions (mentioned in 24 of the 25 studies). In 2001, there were several world famous corporate governance scandals. As a result the Sarbanes-Oxley Act of 2002 was legislated by the United States Congress to strengthen the effectiveness of corporate governance by concentrating on the quality of internal control and financial reporting fidelity. Since then, governance topics have become a crucial aspect for organisations. Furthermore, the corporate governance has been perused and raised more interest in public due to the rise of regulatory and legal deliveries and renowned samples of organisation oversight (Saetang & Haider, 2013). At the same time, pressure is on IT executives to transform into a service organisation, 'run their organisation like a business' and since healthcare institutions are often funded by government and not driven by profit they are impacted by politics (Mike Krey et al., 2012).

A further key feature of context is the *cost pressures* on healthcare institutions (Hoerbst et al., 2011; Mike Krey et al., 2010; Rice, 2015; Tan, Cater-Steel, Toleman, & Seaniger, 2007; Thatcher, 2013; Wilkin & Riddett, 2009; Zutschi et al., 2010). A comprehensive approach to the governance of IT and its resources is becoming critical (Mike Krey et al., 2010). This is illustrated by Lutchen & Collins (2005) and Rice (2015) who state that in the US the cost of healthcare was 15.0% of the GDP in 2005 and rose to 17.2% of GDP in 2015, which sums up to an annual average of $8,608 per patient and experts suggest that they will increase over 5% annually. The same challenge faces Europe, with the German healthcare system representing 10.6% of the GDP in 2009 (Köbler et al., 2010).

Other key features of the context are *IT competency* and *organisational culture*. Wiggins et al. (2006) identify that the healthcare domain is arguably the most transaction-intense domain in our society. Yet compared to other domains, the healthcare domain has significantly underinvested in information technology (IT). The vast majority of healthcare transactions occur via telephone, fax, paper, and electronic data interface (EDI). The result of this archaic information communication system is that much data is not captured, is captured incorrectly or inefficiently, and is difficult to retrieve and use. Additionally, the healthcare industry is increasingly dependent on e-Health applications such as Electronic Health Record (EHR), Electronic Medical Record (EMR), Personal Health Record (PHR), Telemedicine, Laboratory Information System (LIS), Radiology Information System (RIS), and Clinical Decision Support Systems (CDSS). e-Health applications have emerged as integrated healthcare information systems that provide consistency of data and are necessary to serve patient-centred care (Bonney, 2011). The final, and possibly under investigated, context feature was identified by Aasi et al. (2014). They found that culture in national, organisational or group level can play a role in IT governance but this role is rarely explored in academic research.

The inspection of the context has identified four general contextual variables that effect the state of ITG in the healthcare domain: *high political, organisational and public pressures, cost pressures, IT competency* and *organisational culture.*

Developing an understanding of ITG Interventions & Mechanisms

One of the key mechanisms identified in literature is establishment of *governance processes & structures*. Köbler et al. (2009) identified that governance is about systematically determining who makes each type of decision (a decision right), who has input to a decision (an input right), and how these people (or groups) are held accountable for their role. This complies with the definition of ITG by Weill (2004): "*IT Governance represents the framework for decision rights and accountabilities to encourage desirable behaviour of IT".* The intervention that triggers this mechanisms is the *establishment of governance processes & structures.* In the healthcare domain

many organisations choose to establish and adhere to governance structures and processes by adopting an ITG framework (e.g. CobIT and the GRC Framework).

Another key mechanism is *performance measurement*. Performance measurement is found to be crucial in ensuring that information systems in use are working with ultimate performance. Systems with low performance will not be of great asset to the healthcare industry. At the same time healthcare information systems are faced with strong pressures to improve clinical quality, enhance service, expand access, minimise errors and reduce costs. Competitive pressures in the marketplace require healthcare information systems to measure, monitor and report system performance to maintain and expand a market base (Bonney, 2011). The intervention that triggers this mechanisms is *performance management*. Robinson (2005) found that it is best to use a quality and continuous improvement methodology such as the Capability Maturity Model (CMM), Balanced Scorecard or Six Sigma.

A further key mechanism is the *establishment of business rules*. Krey (2015) identifies that when business rules are applied holistically within an organisation, they can add significant value and provide competitive advantage. In a prior study by Krey et al. (2012) identified that the approach of frameworks for business rules (such as CobIT) is very generic and should fulfil the needs of different industries, enterprise sizes and scenarios at the same time. CobIT provides corporate managers, external auditors and IT users with a set of relevant processes, measures and indicators to facilitate the adoption of appropriate IT governance and control in an organisation. The intervention that triggers this mechanism is *adherence to business rules.* Because of the importance of adhering to business rules as opposed to only establishing them, it is important to identify the appropriate standard to provide support at the right level of governance needs, for example (Mike Krey et al., 2012):

- For achieving governance standards and to develop a code of practice
- To provide managers with decision support
- To define and regulate processes in service management
- To deploy these processes and the required procedures, working instructions and monitoring functions

Another intervention that triggers the *establishment of business rules* is *resource management*. In reviewing the reasons for low electronic medical record adoption rates, the literature suggests a variety of reasons such as resources issues including inadequate capital, a lack of capable market solutions and a lack of capable IT resources (Thatcher, 2013).

A fourth key mechanisms is the *development of a risk appetite (*note: a risk appetite of zero risk is also considered as a risk appetite). Risks need to be controlled by implementing different factors; suitable IT risk management methodologies, proper decision makings and sufficient resource management. It is essential to have IT governance to support
any business in encountering, managing and overcoming chaotic business processes (Saetang & Haider, 2013). The intervention that triggers this mechanisms is *risk management.* Risks arising from the poor governance of ICT include:

- Lack of compliance with disclosure and other regulations
- A loss of trust by customers and staff
- Breaches of privacy laws
- Abuse of power and other ethical obligations
- Diversion from achieving targets in strategic plans

Other key mechanisms are *development of educational and training* programs and *IT awareness*. Wilkin & Riddet (2009) identify that although training and development is an intrinsic part of the adoption of ITG, intranets can greatly benefit organisations by limiting the amount of training needed. Even more so, designing the intranet to support educational and training programs proved

crucial as it meant lower skilled project workers could take projects through the lifecycle without close supervision. IT awareness helps organisations to integrate business strategy and strengthen it to suit the business to gain further development (2013). Both the *development of educational and training programs* and I*T awareness* are mechanisms that are triggered by the intervention employee training. Strategy is also an essential part of *employee training*. Organisational wide commitment is required to instituting the change, and the commitment to funding for training and education of the stakeholders (IT users, and hence customers) about the benefits to be realised ,by the new controls, and why they need to change their modus-operandi (Wilkin & Riddett, 2009).

The inspection of the interventions and mechanisms has identified six interventions and six mechanisms. The inventions are; *adherence to governance processes & structure, performance management, resource management, adherence to business rules, risk management and employee training.* The mechanisms are; *establishment of governance processes & structures, performance measurement, establishment of business rules, development of risk appetite, development of educational and training programs, and IT awareness.*

The IT Governance benefits map

In this section the IT Governance benefits map (ITGBM) is presented. The ITGBM serves as a visual-oriented model to provide and enforce an appropriate structure on the ITG Benefits and their Relationships, so that they can be effectively and efficiently understood and utilised. Limiting the synthesis to a 'traditional' SLR can be effective in presenting the originating studies in relation to the researched outcomes but maintaining a narrative account of the relationships between the outcomes can be cumbersome and counter-intuitive. The ITGBM is used as a framework to present the results of the CIMO-analyses. The ITGBM does not represent a novel artefact but rather builds on the Strategy Map (SM) developed by Kaplan and Norton.

The ITGBM is comprised of four main perspectives, each of which consist of a number of categories, which can be thought of as the second-level logical grouping of ITG benefits in the healthcare domain. In antithesis to the SM, and for reasons of semantic consistency, no perspectives directly groups ITG benefits, instead all ITG benefits are grouped in categories.

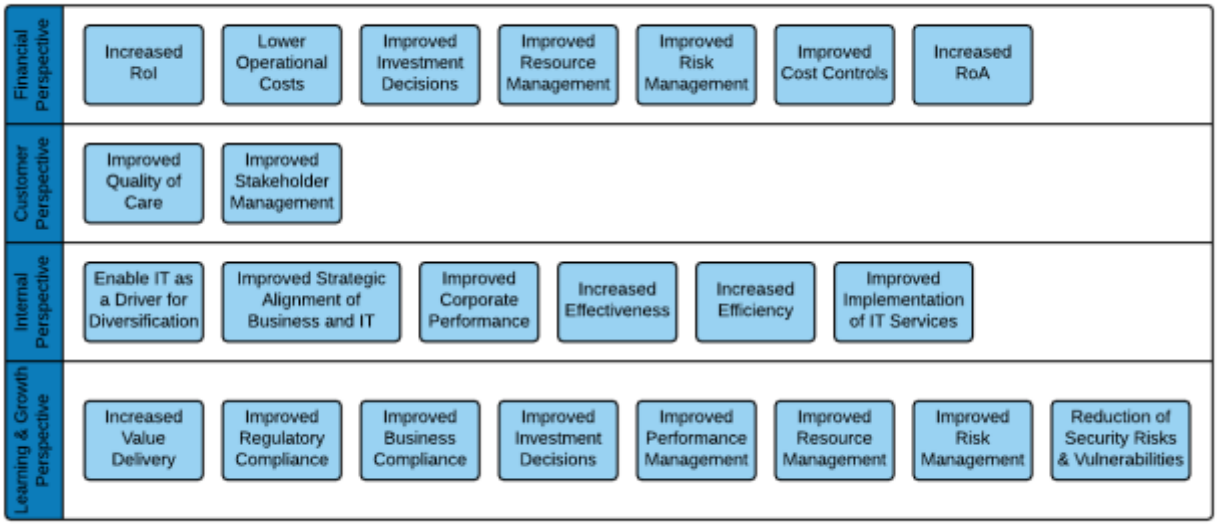
The Financial Perspective. Consists of the Financial Outcome benefit category, which is used to describe how various financial-related organisational ITG benefits contribute to the achievement of possibly *multiple* financial-related strategies. Financial Outcome benefits relate to the financial-related organisational outcomes including, but not limited to, financial gains occurring in relation to or as a result of the reductions in costs and wasted resources.

The Customer Perspective. Consists of the Customer Outcome benefit category, which is used to describe how various customer-value-related organisational ITG benefits contribute to the achievement of possibly *multiple* customer-value-related strategies. Customer Outcome benefits relate to a customer-value objective achieved or to the contributing effect on such an objective. Additionally, they can relate to the achievement of or the contributing effect on a customer-value-related strategy and the realisation/attainment of or contributing effect on a strategically important customer characteristic (e.g. customer group).

The Internal Perspective. Used to describe the various business process benefits/results of implementing an ITG program on internal business processes. It consists of benefits stemming from the implementation of an ITG program to processes relating to the production and delivery of an organisation's products, services and customer acquisition and customer relationships sustainment and growth, product/service/process innovation through R&D programs and the management and reporting of organisational performance on national and/or local regulations, and other aspects of social interest.

The learning and growth perspective. Used to describe those various intangible asset benefits-results of implementing an ITG program on the intangible assets of an organisation, and how these benefits contribute to the achievement of possibly *multiple* organisational strategies. It consists of benefits stemming from the implementation of an ITG program to tangible assets relating to an organisation's stock of workforce competencies, IT infrastructure and information capital applications, and culture, leadership, teamwork and knowledge sharing, and alignment (in the ITGBM, alignment applies to individual employees towards strategic objectives and incentives, between individual employees and between inter/intra-organisational structures). A complete overview of the ITG benefits in the healthcare domain and the studies in which they were identified can be found in Appendix B.

Figure 4: ITGBM displaying all ITG benefits in the healthcare domain.



Organisational Outcomes-Results of the application of ITG in the healthcare domain

After assigning the ITG benefits to the ITGBM categorisation schema, the actual ITGBM was drawn (figure 4). According to Robinson (2005), a formal project management methodology and system development life cycle (SDLC) is needed to ensure that IT value is delivered to businesses on time, within budget, and at the required level of quality. A strong SDLC methodology, used in conjunction with a well crafted IT architecture, enables the delivery of IT services that are integrated, consolidated, and standardised. Operational effectiveness and efficiencies are maximised by the use of service-level agreements (SLA). Third-party management and sourcing decisions should be made in partnership with the business and IT, and a process should be in place to translate the necessary SLA and quality requirements into contractual obligations. In addition Bonney (2011) identified that the strategic alignment of the business maximises business value through the development and maintenance of effective IT governance structures and processes, risk management and resource management.

Interesting is the fact that ITG can benefit the quality of healthcare (Beratarbide & Kelsey, 2009) and decrease the number of clinical errors (Hoerbst et al., 2011; Wiggins et al., 2006). This implies that investments into ITG can directly benefit the patients and ITG should be seen as part of the core business (delivering healthcare). Furthermore ITG can help decrease cost by decreasing the IT budget per patient day (Rice, 2015) and increasing the appeal to investors such as grantors (M. Krey, 2010; Lutchen & Collins, 2005).

In total we identified 26 unique CIMO relationships. A complete graphic overview of the relationships, and the studies mentioning them, can be found in Appendix D. For readability reasons we have added a subset of the relationships, and the studies mentioning them, in figure 5. Figure 5 only contains those relationships that were found in more then one study. The references (numbers in figure 5 - source paper) can be found in Appendix E.

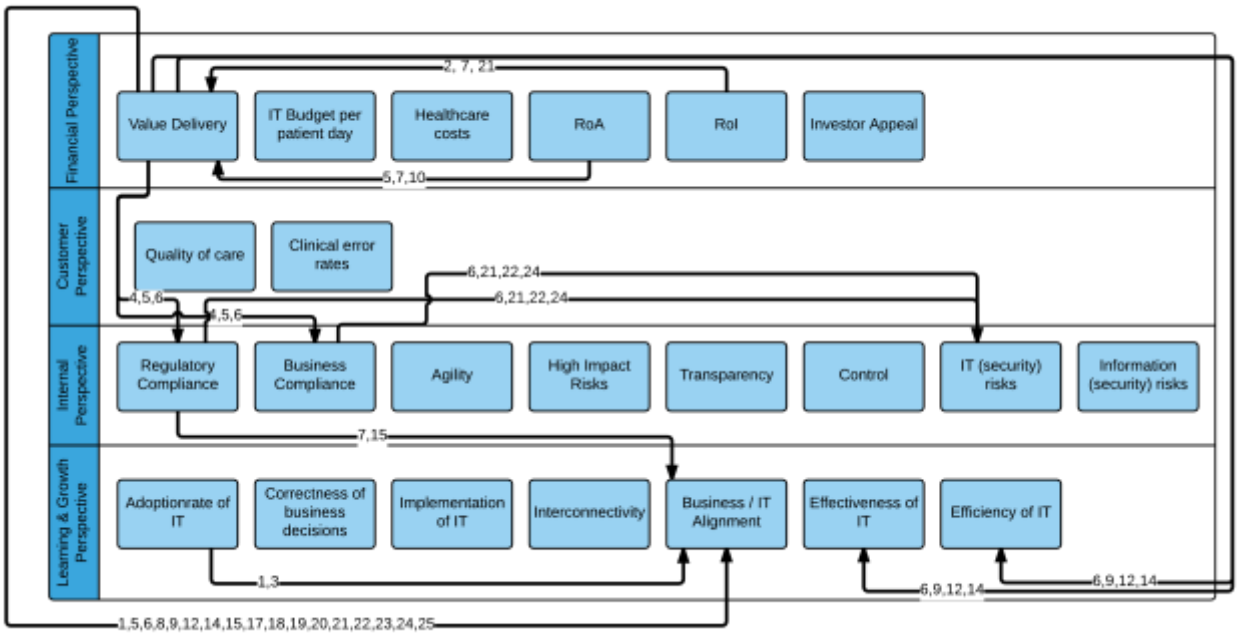


Figure 5: TGBM displaying all the ITG benefits in the healthcare domain including the relationships among them that were mentioned more than once.

ITG design proposition for the healthcare domain

Searching the research base of a discipline from the perspective of a given field problem usually results in identifying whole sets of variables (C), (I), (M) and (O). These deal with both overall design principles as well as more detailed variables, giving the set a multilevel and possibly nested structure. But a special characteristic of design propositions lies in their combinational nature. That is what I found in the field of ITG in the healthcare domain, offering not precise instruction to practitioners, but providing an opportunity to configure the CIMO-logic as a result of the rich evidence.

The design proposition deducted from the CIMO-analysis runs as follows: in a context characterised by high political, organisational and public pressures, cost pressures, different levels of IT competency and distinct organisational cultures, in order to improve the benefits as mentioned in figure 5:

I. Adopt governance structures and processes by adopting an ITG framework (e.g. CobIT and the GRC Framework).
II. Adopt a quality and continuous improvement methodology such as the Capability Maturity Model (CMM), Balanced Scorecard or Six Sigma.
III. Establish business rules to provide support at the right level of governance needs, for example;
   - For achieving governance standards and to develop a code of practice
   - To provide managers with decision support
   - To define and regulate processes in service management

- To deploy these processes and the required procedures, working instructions and monitoring functions.

IV. Controlling risks by implementing different factors; suitable IT risk management methodologies, proper decision makings and sufficient resource management.
V. Adopt resource management for the appropriate utilisation of given IT resources.
VI. Develop education and training materials to achieve organisational wide commitment to instituting the change, and commitment to funding for training and education of the stakeholders (IT users, and hence customers). In addition education and training helps individuals understand why they beed to change their modus-operandi.

It is important to note that the interventions mentioned above are interrelated. It is not possible to achieve all benefits to their full extent by implementing only a subset of the interventions mentioned above. However, not all outcomes (benefits) are related to another. The result is that certain interventions can deliver (some of) the benefits on their own. This implies that organisations in the healthcare domain can gradually adopt these ITG interventions which can help build momentum for further adoption of ITG in the healthcare domain.

4. Discussion

Major Findings & Quality of the Evidence. This research provides a rich, consolidated and scientifically established picture of the potential organisational benefits of ITG in the healthcare domain. In this context *rich* translates as a full account of the available research findings, unlike similar research that reported on ITG benefits (in general) without taking into account any relevant context. This research sought to understand and report not only on the context within which certain benefits appear as results of the application of an ITG program on an organisational structure, but also the mechanisms of ITG that cause them. The analysis of the 25 eligible studies revealed the current state of the scientific and practitioner's literature concerning the potential benefits of ITG in the healthcare domain, as describing 4 unique contexts (*high political, organisational & public pressures; cost pressures; IT competency; organisational culture)* within which ITG has been found to deliver value in the healthcare domain, 23 unique benefits of ITG in the healthcare domain, and 6 mechanisms that generate value of ITG in the healthcare domain, triggered by 6 interventions. Certain contexts and multiple benefits have been found to semantically overlap or to group to more than one notion. Some benefits might appear vague or of high-level abstraction. These facts are characteristic of the different intentions of the original studies' authors. The 'affected' elements were incorporated with the rest of the results without any alterations since that could potentially introduce a range of issues from semantic discrepancies to non-existent cause and effect relationships. However, all the interventions found in the study are very abstract and not unique to the contexts in the healthcare domain. Looking at the hype cycle (Gartner, 2016) we can understand what is happening. Researchers and practitioners alike have had high expectations of ITG in the healthcare domain but these expectations have been impossible to achieve. The studies illustrate that ITG is a broad field and that implementing ITG is not an easy task. Research falling short of easy answers to the implementation of ITG in the healthcare domain has led to the trough of disillusionment.

Meaning & Importance of Major Findings. The results of this research project respond to recent calls for research for the specific benefits of ITG in the healthcare domain and the relationships among them. This is particularly relevant today due to the enactment of the Dutch privacy laws. Since January 1st 2016, board members of Dutch organisations can be imposed a personal recoverable fine (for more information see *www.autoriteitpersoonsgegevens.nl*). This study delivers additional value in that it takes into consideration the contexts in which ITG in the healthcare domain occur and the mechanisms through which the benefits are generated. Relating ITG benefits, applicable in the healthcare domain, with the specific mechanisms of ITG that generate them, provides an answer on how the benefits were actually brought about and offers an additional, critical layer of understanding of the applicability of ITG in the healthcare domain.

Overall Completeness & Applicability of the Evidence. The results are providing a competent amount of evidence regarding the identification of the benefits of ITG in the healthcare domain, as

these are perceived or established by researchers and practitioners of the field. The evidence put forth by the review, however, is only transferable to the extent that the individual, eligible studies' results are. The results of the literate review should be seen as potential benefits of ITG in the healthcare domain and their realisation in real-world scenarios might depend on many other contextual factors that require careful examination. Furthermore, there might exist additional benefits of ITG in the healthcare domain, not yet explored in research. The results of the SLR carry several implications for both researchers and practitioners. First of all, enhancing the understanding of ITG in the healthcare domain by providing valuable information on potential ITG benefits in the healthcare domain and their relationships, their applicability (context), and their mechanisms. Secondly, enabling the scientifically grounded reasoning on how ITG in the healthcare domain might contribute to the achievement of certain business goals, establishing thus the business case for ITG and ITG projects in the healthcare domain. Finally, providing a list of ITG benefits in the healthcare domain that can function as a source for defining relevant objectives for ITG programs in the healthcare domain.

Potential Biases & Limitations in the Review Process. The SLR method utilised enabled a highly structured process with transparent and traceable results: all aspects of the evidence produced and the relevant rationale that produced them, are readily available and reported. However, the studies' eligibility compliance was undertaken solely by the researcher. No ambiguities occurred but due to the fact that all research was undertaken solely by the principal researcher, a certain level of bias may exist. In addition, although the study contends to be highly inclusive regarding the total number of available studies on the subject of ITG in the healthcare domain, it is improbable that all of them are within the reported search process, for multiple reasons. It is expected that additional studies have become available in other languages than the one our search is focused on. Additionally, it is expected that more gray literature exists in sources that the researcher does not currently has access to or is unaware of (e.g. organisational reports).

5. Conclusion

In this section we answer the research question that I posed in section 1: "What are the benefits of IT Governance for the healthcare domain?".

The current state of ITG in the healthcare domain identified that important benefits can be achieved in the healthcare domain but budgets are low (compared to other domains) and misspent (more is spent on operations than on innovation). At the same time, ITG does not get the top management commitment that it needs and is seen as a great 'tool' for investment decisions. IT adoption increases adherence to guideline or protocol based care, reduces adverse drug events and reduces serious medication errors. In an attempt to validate an ITG Maturity Model, the weightings have been adjusted because Gordijn (2011) found that, in the Dutch healthcare domain, leadership is more important due to the fact that managers have to deal with professionals involved in the decision making process since hospitals are professional organisations.

A CIMO-analysis identified four key features of context: *high political, organisational and public pressures; cost pressures; IT competency* and *organisational culture*. These factors influence the effect of ITG in general and the interventions, mechanisms and outcomes. The six interventions that were identified are *adherence to governance processes & structure, performance management, resource management, adherence to business rules, risk management and employee training.* The mechanisms are; *establishment of governance processes & structures, performance measurement, establishment of business rules, development of risk appetite, development of educational and training programs, and IT awareness.* Together these interventions and mechanisms can create numerous outcomes (benefits) such as *value delivery*, *quality of care* and *business/IT alignment* (a full overview of all outcomes can be found in the ITGBM in figure 4).

The CIMO-analysis yields a design proposition which runs as follows: in a context characterised by high political, organisational and public pressures, cost pressures, different levels of IT competency and organisational cultures, in order to improve the benefits as mentioned in figure 5:

I. Adopt governance structures and processes by adopting an ITG framework (e.g. CobIT and the GRC Framework).
II. Adopt a quality and continuous improvement methodology such as the Capability Maturity Model (CMM), Balanced Scorecard or Six Sigma.
III. Establish business rules to provide support at the right level of governance needs, for example;
   - For achieving governance standards and to develop a code of practice
   - To provide managers with decision support
   - To define and regulate processes in service management
   - To deploy these processes and the required procedures, working instructions and monitoring functions.
IV. Controlled risks by implementing different factors; suitable IT risk management methodologies, proper decision makings and sufficient resource management.
V. Adopt resource management for the appropriate utilisation of given IT resources.
VI. Develop education and training materials to achieve organisational wide commitment to instituting the change, and commitment to funding for training and education of the stakeholders (IT users, and hence customers). In addition education and training helps individuals understand why they beed to change their modus-operandi.

Even though these interventions and their outcomes are related certain interventions can deliver (some of) benefits by themselves because not all outcomes are related to another. This implies that certain interventions (I… VI) can be implemented without necessarily implementing all the other interventions. This in turn aids organisation in gradual adoption of ITG and can help build momentum for further adoption of ITG in the healthcare domain.

Suggestions for further research. Additional systematic reviews should be conducted in the future with the aim of locating multilingual contributions and additional gray literature. Furthermore, due to the absence of healthcare specific interventions and benefits in literature, I call for more original, rigorously designed and executed reports on the ways ITG contributes to the achievement of specific organisational goals in the healthcare domain. The expectations should not be as high as they have been and the individual studies should aim to provide guidelines and principles usable by practitioners and researchers alike. This in turn can help the development of ITG in the healthcare domain thrive and push towards the slope of enlightenment (the next phase in the hype cycle). Finally, I invite researchers to make use of the ITGBM for the healthcare domain as a tool for charting the existing academic research.

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Appendix A - Keywords list

IT Governance
IT Governance performance
IT Governance process
IT Governance structure
IT benefits management
IT Governance benefits
IT decision rights
IT decision making
IT organizational alignment
IT Governance maturity
IT Corporate Governance
IT GRC
IT Value
IT Service Management
IT Control
ICT Governance
Information Technology Governance
Business/IT Alignment
Public and private sector organisations
Governance model
Healthcare
Healthcare
E-health
Healthcare information technology
Healthcare information technology
Health information governance
Medical Informatics
Organizational Performance
Public Sector
GRC
IS Organization design
IS centralization
IS integration
IS performance
IS success/failure

Appendix B - Papers included in the study

Peterson, R., Parker, M., Ribbers, P., Peterson, R. R., & Parker, M. M. (2002). Information Technology Governance Processes Under Environmental Dynamism : Investigating Competing Theories of Decision Making and Knowledge Sharing. *ICIS 2002 Proceedings*, 562-575.

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Appendix C - ITG Benefits

Correctness of business decision (Mike Krey et al., 2012)
Business / IT alignment (Rice, 2015)
RoA (Gordijn, 2011; Mike Krey et al., 2012)
RoI (Mike Krey et al., 2012; Mike Krey et al., 2010; Tan et al., 2007; Wiggins et al., 2006)
High impact risks (Mike Krey et al., 2012; Lapão, 2011)
Regulatory compliance (Gordijn, 2011; M. Krey, 2010; Mike Krey, 2015; Mike Krey et al., 2012; Mike Krey et al., 2010; Lapão, 2011; Lutchen & Collins, 2005; Robinson, 2005; Saetang & Haider, 2013; Wiggins et al., 2006; Zutschi et al., 2010)
Business compliance (M. Krey, 2010; Mike Krey, 2015; Mike Krey et al., 2012; Mike Krey et al., 2010; Lutchen & Collins, 2005; Robinson, 2005; Wiggins et al., 2006)
Value delivery (Aasi et al., 2014; Beratarbide & Kelsey, 2009; Bonney, 2011; Borousan, Hojabri, Manafi, & Hooman, 2011; Gordijn, 2011; Hoerbst et al., 2011; Köbler et al., 2009; M. Krey, 2010; Mike Krey, 2015; Mike Krey et al., 2010; Mike Krey, Keller, Harriehausen, & Knoll, 2011; Lutchen & Collins, 2005; Peterson et al., 2002; Rice, 2015; Robinson, 2005; Saetang & Haider, 2013; Thatcher, 2013; Wiggins et al., 2006; Wilkin & Riddett, 2009; Zutschi et al., 2010)
IT budget per patient day (Rice, 2015)
Effectiveness (of IT) (Köbler et al., 2009; M. Krey, 2010; Mike Krey et al., 2011)
Efficiency (of IT) (Köbler et al., 2009; M. Krey, 2010; Mike Krey, 2015; Mike Krey et al., 2011)
Investor appeal (M. Krey, 2010; Lutchen & Collins, 2005)
Transparency (Mike Krey et al., 2011)
Control (Mike Krey et al., 2011)
Implementation of IT (Saetang & Haider, 2013)
IT (security) risks (Aasi et al., 2014; Bonney, 2011; Mike Krey, 2015; Mike Krey et al., 2010; Lutchen & Collins, 2005; Zutschi et al., 2010)
Information (security) risks (Aasi et al., 2014; Bonney, 2011; Mike Krey, 2015; Mike Krey et al., 2010; Lutchen & Collins, 2005; Zutschi et al., 2010)
Quality of care (Beratarbide & Kelsey, 2009)
Healthcare costs (Beratarbide & Kelsey, 2009)
Agility (Mike Krey et al., 2010)
Clinical error rates (Hoerbst et al., 2011; Wiggins et al., 2006)
Adoption rates of IT (Bonney, 2011; Thatcher, 2013)

Appendix D - Relationships identified in literature

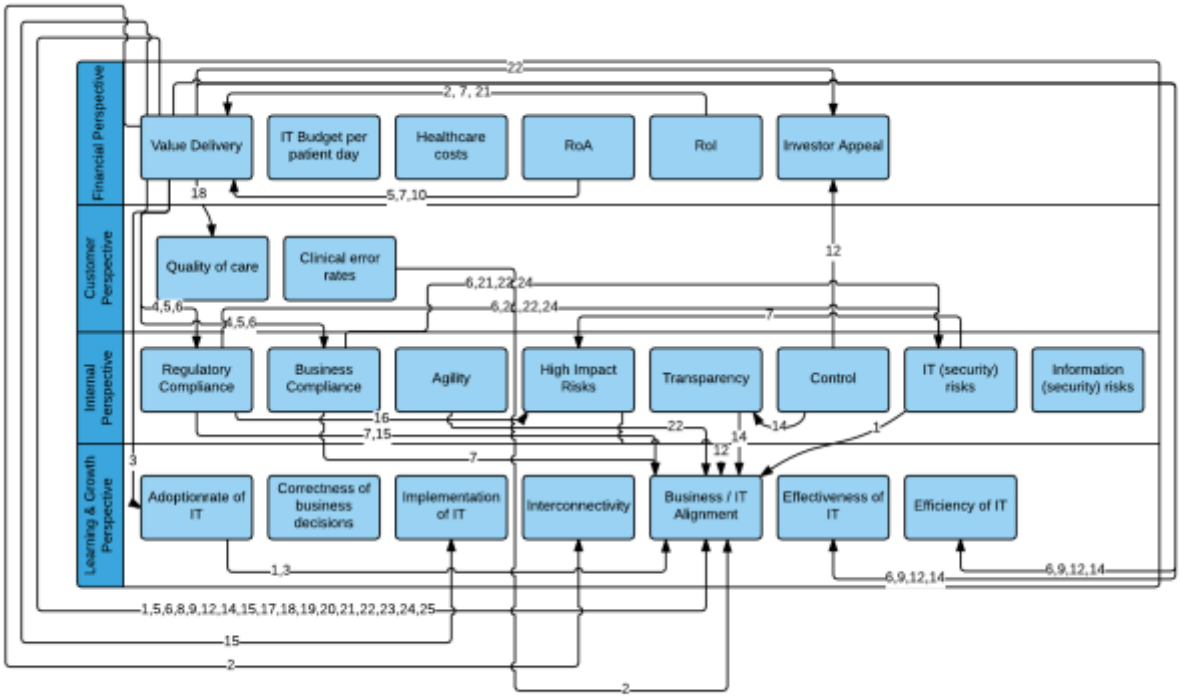

Figure 6: TGBM displaying all ITG benefits in the healthcare domain including their relationships.

Appendix E - Source papers ITGBM relationships

1. IT Governance for e-Health Applications (Bonney, 2011)
2. Entrepreneurial IT Governance: Electronic Medical Records in Rural Healthcare (Wiggins et al., 2006)
3. IT Governance in Acute Healthcare: A Critical Review of Current Literature (Thatcher, 2013)
4. IT excellence starts with governance (Robinson, 2005)
5. Validation of an IT governance maturity assessment method - Adjustment to the healthcare domain (Gordijn, 2011)
6. Significance and Current Status of integrated IT GRC in Healthcare: An Explorative Study in Swiss Hospitals (Mike Krey, 2015)
7. Approach to the Evaluation of a Method for the Adoption of Information Technology Governance, Risk Management and Compliance in the Swiss Hospital Environment (Mike Krey et al., 2012)
8. Healthcare information technology: correlational study of governance maturity and patient costs (Rice, 2015)
9. How German hospitals govern IT – an empirical exploration (Köbler et al., 2009)
10. Implementing Centralised IT Service Management: Drawing Lessons from the Public Sector (Tan et al., 2007)
11. Information Technology Governance Processes Under Environmental Dynamism: Investigating Competing eories of Decision Making and Knowledge Sharing (Peterson et al., 2002)
12. Information Technology Governance, Risk and Compliance in Healthcare – a Management Approach (M. Krey, 2010)
13. IT Governance and Types of IT Decision Makers in German Hospitals (Köbler et al., 2010)
14. Towards a Classification of Information Technology Governance Frame (Mike Krey et al., 2011)
15. IT Governance Implementation in Corporate Environments: A Case Study of an International Hospital in Thailand (Saetang & Haider, 2013)
16. Organizational Challenges and Barriers to Implementing IT Governance in a Hospital (Lapão, 2011)
17. The Influence of Culture on IT Governance: A Literature Review (Aasi et al., 2014)
18. eHEALTH Governance, a key factor for better healthcare (Beratarbide & Kelsey, 2009)
19. IT Governance for e-Health Applications (Borousan et al., 2011)
20. The Impact of IT Governance on Organizational Performance (Liang & Wu, 2011)
21. IT Governance in a Healthcare Setting: Reinventing the Healthcare Industry (Lutchen & Collins, 2005)
22. IT Governance and its impact on the Swiss Healthcare (Mike Krey et al., 2010)
23. The status of IT service management in healthcare - ITIL in selected European countries (Hoerbst et al., 2011)
24. ICT Corporate Governance: A Case Study of a Not-for-Profit Community Healthcare Organisation (Zutschi et al., 2010)
25. IT governance challenges in a large not-for-profit healthcare organization: The role of intranets (Wilkin & Riddett, 2009)