IT in Health Care: A Business Enabler?

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Abstract—**Information processing in health care demands reliable, relevant, systematic, integrated, and managed data throughout care delivery. This leads, even with IT, to increased and time-consuming activities and can cause potentially dangerous situations for the patient as important data may not be available when needed, which in turn can lead to wrong diagnostic or therapeutic decisions. Consequently, hospital IT executives must balance many competing priorities. These endeavours require, in addition to the appropriate utilisation of given IT resources, a far-sighted alignment of IT issues with objectives, and a thorough understanding of uncertainties and legal obligations. This approach to integrated IT governance, IT risk management, and IT compliance (IT GRC) in the hospital Environment is the subject of the work presented here. This investigation is associated with a survey that has been conducted in 2009 and allows therefore drawing conclusions on the progress of IT GRC management in Swiss hospitals over the last 5 years. The findings revealed that IT GRC in health care is still all too often seen as the realm and sole responsibility of the CIO and the IT department. The findings proved that IT GRC has not been utilised sufficiently by the executive management of many hospitals, especially the public ones. The findings revealed the reasons for a less pervasive spread of managed IT GRC can be structured into four main categories representing the greatest barriers to a successful convergence of integrated IT GRC.**

Keywords—Governance, Risk Management, Compliance, Healthcare, Switzerland

I. INTRODUCTION

As seen in other developed countries such as the United States or Germany, reforms initiated within hospitals show a tremendous potential for improvements. Examples include optimisation effects by transforming existing (organisational) structures, consolidation of services provided, or a more efficient use of information technology (IT) [24]. Nevertheless, care delivery is *"information intensive"* and IT is not, per se, the cure for all obstacles in health care [25] (p. 208). Information systems such as hospital information systems (HIS) or radiology information systems (RIS) generate, process, retrieve, and store information about health care, which includes to a great extent sensitive patient data (e.g. medication, laboratory findings, or X-ray images) that various groups of health care professionals inside and outside the hospital need accurate access to.

Because the systematic management of assets, systems, and stakeholders are essential to the overall effectiveness of IT in hospitals, hospital IT executives must balance many competing priorities, such as reducing operational costs, enabling the hospital, its clinics, and departments to adapt quickly to changing needs, and ensuring compliance with legal obligations while increasing patients' and employees' satisfaction. This approach to integrated IT governance, IT risk management, and IT compliance (IT GRC) in the hospital environment is the subject of the work presented here. It is an approach that addresses not only the establishment of business rules, but, more importantly, how those rules are adopted into sensible organisational structures and embedded into day-to-day business processes while considering each organisation's unique cultures, subcultures, and groups, which can possess their own attitudes and patterns of behaviour.

The following investigation takes into account the Swiss health care sector in general, and Swiss hospitals in particular, but may comprise various aspects that can be found in different countries and health care systems.

The Swiss health care sector has been selected for this investigation as it is currently facing the endeavour to achieve a fundamental reorganisation. Since 2009, hospitals in Switzerland have been transitioning to a new remuneration approach providing case-based payments. The SwissDRG was introduced in 2012, and has become the dominant payment mechanism for hospitals in Switzerland. As in many other countries that have already introduced DRGs (e.g. Germany and Austria), the new reimbursement system promises transparency and comparability of inpatient services across hospitals rather than cost savings.

The work presented her is structured as follows: In the second section the problem statement is clarified and the objectives are outlined. In the third section the research questions are defined and a literature review is conducted investigating contributions in the field of GRC. With a focus on the demand for a hospital-specific approach for the adoption of IT GRC, the implementation of IT GRC principles in the Swiss hospital environment is discussed in the fourth section. Final remarks are given in section five.

2. PROBLEM STATEMENT

Challenges facing the endeavour to achieve a fundamental reorganisation of the Swiss health care

sector and the therein implied approach to IT GRC include: (1) legal restraints caused by Switzerland's federal structure with its complex system of powers and responsibilities, (2) the political tradition of direct democracy and governance through consensus, (3) closely-meshed organisational and social structures within the hospital and among its stakeholders, and (4) an under-represented role of IT characterised by years of increased heterogeneous IT systems. These are just a few aspects making the health care sector a sensible field for the management of IT [25] (p. 218).

On the other extreme, in the last years, a range of best practices (e.g. Control Objectives for Information and Related Technology (CObIT), Committee of Sponsoring Organisations of the Treadway Commission Enterprise Risk Management Framework (COSO ERM), or GRC Capability Model), proprietary frameworks (e.g. Microsoft Operations Framework (MOF)), standards and norms (e.g. ISO 13335, ISO 27001, ISO 31000:2009), as well as reference models for IT service management such as the well-known standard ITIL (Information Technology Infrastructure Library) have been developed. These frameworks are summarised in a stricter or broader sense under the topic of IT GRC.

Notably, these frameworks are not alternative treatments of the same issue and, indeed, there is considerable overlap between them, which make a clear assignment to the individual aspects of IT GRC, whether IT governance, IT risk management, or IT compliance, more difficult. In addition, most of the approaches lack sound methodical validity, acknowledged scientific rigour, and provide only vague suggestions about their underlying conceptions and structures.

Representative studies, which have been conducted in both Switzerland and trans-nationally, let us assume that existing approaches in the field of IT GRC that address the multi-layered challenges of the health care market can be classified as inadequate and non-sustainable [12, 15, 17].

Although the hospitals are aware of the demand for change and reorganisation, little evidence for improvement can be realised as these studies concluded that IT GRC principles are less marked in most hospitals today.

In the upcoming section the theoretical foundations are presented. A literature review provides the most recent state of GRC research, leading to an examination of the status quo on integrated IT GRC in the Swiss hospital environment.

3. THEORETICAL FOUNDATIONS

A. Research Questions

This exploratory study is based on the frame of reference investigating the interaction of integrated IT GRC introduced by Racz and his colleagues [29]. It serves as a theoretical framework and systematisation of the formulated research questions. The research questions are developed with the help of representatives of industry associations and hospitals in several iterations.

According to the research problem outlined in the previous section the research questions are defined as follows:

1. How is the IT organised in Swiss hospitals?
2. How advanced is the knowledge of and the attitude about IT GRC in general and especially about CObIT among CIOs and hospital IT managers in Swiss hospitals?
3. How advanced are the Swiss hospitals with regard to the implementation of IT GRC principles? What are the reasons that hinder the implementation of these principles?
4. Which organisational units or departments are involved in IT decisions affecting the entire hospital?
5. Which differences between hospitals according to the ownership can be observed?

Finally, several experts tested the questions regarding consistency and clarity with the help of pre-tests.

B. Integrated IT GRC for the Hospital Environment – A Literature Review

Methodology. Thoroughly investigating the fast-moving pace of IT GRC and its significance beyond academia, non-research sources may provide valuable insights into related issues and future trends. For this reason, the review focusses on literature grounded in science, as well as practice. In order to classify existing approaches and identify their relevance for the identified problem, the taxonomy framework by Cooper [8] was applied. As a result, the review is conducted using different criteria. In the first stage, to provide transparency on the review results, literature sources are examined which have a direct relation to the health care sector and which focus on integrated GRC. This configuration contributes directly to the derived research problem (see Section 2).

The following databases were searched, using *"health care" XOR "hospital" AND "information technology" AND "governance" AND "risk management" AND "compliance" XOR "GRC"* as search terms in titles and abstracts: (1) ACM Digital Library, (2) IEEE Xplore Digital Library to explore sources with a technology perspective such as the development and implementation of GRC systems, and (3) AIS Electronic Library (AISeL). In addition to the management and technical related databases, sources dealing with topics for medical informatics were searched in order to be in line with the current context of this research work: (4) PubMed Central (PMC), (5) BioMed Central (BMC), and (6) Health care Information and Management Systems Society (HIMSS). In addition to these, mostly journal related databases, (7) the SprinerLink database is queried, which covers recent journals, books, and book series to the analysis.

Discussion. The literature review indicates that it is likely that academia will show a continuing and even increasing interest in GRC topics. However, given the insights gained from review reliable empirical data on IT GRC in the health care sector is missing and represents therefore a desirable direction for further research.

It becomes evident that GRC, including its subtopics, has become one of the focus areas for study as most of

the articles within the last three years are assigned to the field of IT GRC in a more specific or wider sense [11]. Although IT GRC research has gained enhanced attention in academia and practice in recent times, there is still little empirical evidence proving, for example, a positive impact applying GRC principals on financial or market results. Most of the practice-related contributions, whether they are published by profit or non-profit organisations, suffer from the same lack of methodical and scientific rigour (e.g. [9; 13; 22]). They mostly offer only vague suggestions about their foundations and validity. Even to validate their possible scientific contribution is difficult in the aftermath as the access to most of the reports and contributions published require a membership subscription, and are, therefore, accessible only to a small community. The review of the literature reveals that research priorities within the subtopics have not emerged so far, and that a great variety of aspects, ranging from a strong technical consideration involving the development of an IT GRC application [2; 26; 16; 20], to a high-level investigation on IT GRC key activities can be found [31]. This biased or even vague research focus may have been hampered by the fact that a clear understanding of GRC issues or even common acronyms are still missing (e.g. GRC IS as used by Butler and McGovern [5] or IT GRC as used by Puspasari and colleagues [26]).

Motivated by a lack of reliable empirical data on IT GRC in the health care sector in general, and the Swiss hospital environment in particular the next section examines the status quo on integrated IT GRC.

4. CURRENT STATUS OF IT GRC IN SWISS HOSPITALS – A 5-YEAR COMPARISON

This section seeks to empirically verify the gained insights from the previous sections, outlining the hospital as complex and sensitive environment for the adoption of IT GRC (see Section 2). With a focus on the demand for a hospital-specific approach for the adoption of IT GRC, the implementation of IT GRC principles in the Swiss hospital environment is discussed. Although the separate elements of IT GRC are widely accepted, applied, and empirically validated in several industries, resulting in positive impact on the enterprises' effectiveness, integrated IT GRC is still less widespread in the Swiss hospital environment. This investigation is associated with a survey that has been conducted in 2009 by Krey and his colleagues [17] and allows therefore drawing conclusions on the progress of IT GRC management in Swiss hospitals over the last 5 years.

C. Study Design and Sample Selection

Similar to the previous investigation in 2009, standardised questionnaires and face-to-face interviews with CIOs and IT executives of 15 Swiss hospitals were carried out in 14 cantons, covering all geographic regions within Switzerland (i.e. German, French, Italian, and Rhaeto Romance region).

The design for the current study is based on a survey research method [30] and was discussed and verified with the responsible persons of our university's ethics committee. The survey method was selected as it's especially suitable to gain better understanding of a problem and its reasons by quantifying certain aspects of it [30]. Although trying to quantify certain phenomena the study is primarily intended to explore the given problem context in order to enable further detailed and hypothesis-based research.

The survey was conducted from February 2015 until August 2015 in order to identify the lessons learned in implementing and embedding IT GRC. The survey covered nearly 23% of all general hospitals and 42% of all beds according to the latest annual report by the Federal Statistical Office in Switzerland [3]. The purpose of the research was to reach members of the IT management to determine their priorities and actions taken relative to IT GRC, as well as their need for methods to help ensure its effectiveness.

D. Data Collection

This exploratory study is based on the frame of reference investigating the interaction of integrated IT GRC introduced by Racz and his colleagues [29] (see Figure 1). Their approach serves as a theoretical framework and systematisation of the formulated interview questions. The interviews were based on previously designed and tested interview guidelines. These questions are grouped according to the three identifier IT GRC areas containing eight open and 48 closed questions:

- Seven general questions with regard to the hospital organisation. These questions include information about the number of beds, type of hospital and type of ownership.
- Twenty-eight questions with regard to the use of IT in the hospital to determine the organisational and technical maturity. Topics covered by this section are organisation of IT including financing, current and planned IT systems, IT service management approach and customer- and user relationship management.
- Twenty-one questions about the current implementation of IT GRC principles, questions about the awareness of these principles and the potential interest and willingness to make use of existing best practices such as CObIT and ITIL.

In order to assess the hospitals' capabilities in dealing with certain IT GRC areas the much-noticed CObIT maturity model [14] (p. 17) was applied.

Each level of the six-point rating scale ranging from (0) non-existent to (5) optimised represents a simplified performance measurement indicating how well the hospital has achieved this level in the wide array of IT GRC areas and, at the same time, providing informative suggestions for the action planning. The rating does not allow any inference to a participant's identity, but rather leads to a Switzerland-wide perspective on IT GRC. The method of transcription (based on the written notes) was used to analyse the interviews and made a mapping into the relevant rating scale possible [30]. To analyse the

answers to open questions or those where interviewees could provide additional explanations, techniques of content analysis according to Saunders [30] were applied. Subsequently the analysis is based on descriptive statistics indicating the relative or absolute frequency of answers with regard to the hospital and question.

E. Findings

In the subsequent section the results from the study are described. The presentation of the results follows the structure of the interview guidelines.

To begin with, the findings revealed that IT GRC in health care is still all too often seen as the realm and sole responsibility of the CIO and the IT department. The findings proved that IT GRC has not been utilised sufficiently by the executive management of many hospitals, especially the public ones. Thirty per cent of hospitals (n=5) surveyed believed that only one-fifth of their business managers could explain their IT GRC arrangements. That is less than the half compared to the survey that has been conducted 5 years ago by [17].

Health care requires that specific attention is given to the status of IT, the organisational principles, and cultural styles. The survey further revealed that more than the half of the hospitals (n=8) have adopted CObIT or other proprietary frameworks. In comparison to the survey by [17] that is an increase of more than 150 per cent. Considering these implementations in more detail, the respective hospital IT executives stated that they use only a small part of each framework for their purposes, such as the concept of control objectives within CObIT 4.1 for determining financial risks on IT investments. Another interviewee outlined that his department uses a proprietary framework to define the strategic direction for IT solely from the cost perspective. In this hospital, the framework is primarily used to provide a reporting structure on the state of IT in general, and related IT projects in particular. The implementation has been described as a defined process ensuring that the board frequently receives adequate information on IT costs. However, a cost-benefit equation outlining the efficiency and effectiveness of IT or an assessment of business risks is not performed. Consequently, the framework is in the exclusive responsibility of the hospital board of directors.

In contrast, ITIL is used by two-third of all hospitals as an approach to IT service management (n=10). However, only one out of three implementations has been classified as a standardised and documented process, whilst no one confirmed their ITIL approach as managed in terms that processes have been refined to a level of good practice (see Figure 1).
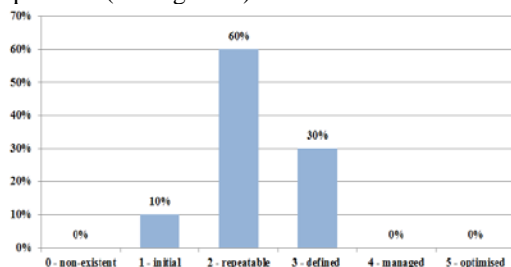

Figure 1.   Classification of ITIL approaches

The investigation on the acceptance and increased usage of IT services revealed that the concept of IT services management and the utilisation of related frameworks are still not widely recognised in the hospitals surveyed. Only 20% (n=3) of the hospitals have implemented ITIL or parts thereof. And 40% (n=6) of the IT executives in Switzerland revealed that they do not plan any ITIL initiative in the next two years. Exploring the reasons for the sceptical attitude towards IT service management, the interviews revealed that different priorities, lack of motivation, and budget constraints were mentioned as the three major obstacles to improving the situation.

The investigation revealed that IT issues were still only occasionally a topic on the executives' agenda. However, the findings indicated that 33% (n=5) of the hospitals have no IT board representing the strategic perspective, outlining the role of IT, making the long-term planning for IT investments, or defining the field of duties of the IT manager. In comparison to the survey by Krey and his colleagues [17] that is a sweeping change.

66% (n=10) had established IT committees, whose chairperson is, at the same time, a member of the hospital management and, therefore, representing IT issues at the management level. The remainder of the hospitals have unorganised and non-binding committee structures with no discretionary competence and which do not report to any management level.

The findings indicated that in more than half of the hospitals surveyed (66%) a classical strategy alignment process is in place. The rest of the hospitals surveyed revealed, that their IT strategy has been mainly influenced by results from discussions with the hospital management and IT-internal about the application architecture, but in most cases the subsequent strategies lack objectives. Business-IT alignment is performed by these hospitals at the invitation of organisational units, and thereby demonstrates a quite informal and disorganised procedure process.

Considering the interaction between IT compliance and IT governance (see Figure 1), it becomes obvious that aligned IT governance structures provide the basis for ensuring that IT in the hospital environment is compliant with certain laws and regulations, as well as internal policies and specifications. Therefore, related structures allow for an efficient clarification and hospital-wide consolidation of requirements arising from legislation specific for IT, such as defining compulsory data storage periods of patient records or determining that only authorised health professionals can access said data. In this respect, IT governance ensures the effective control and sustainable direction of IT in hospitals making sure that IT compliance is verifiable.

Questions about the strategic alignment between clinics (business) and IT using a defined strategy revealed that only 66% (n=10) of the surveyed hospitals have an IT strategy in place. However, it is not mentioned to what extent these IT strategies are aligned with the overall corporate strategy. At the same time, the lack of aligned strategies may hamper integration efforts across the

hospital. The lack of executives' awareness of IT GRC principles are therefore on a similar level compared to the investigation in 2009 [17].

Without an adequate consideration of clinical priorities related risks cannot be managed, such as the IT impact on clinics and departments cannot be verified at any time and related counter-measures cannot be taken in a timely manner.

Consequently, related management questions, such as "what is the quantified risk potential and the related harm in case that the HIS is unavailable?" can be answered. With the help of downtime estimation, an approximation of the longest acceptable downtime that the business (e.g. radiology department) can endure while still remaining viable is assessed.

Gained insights from an active management of risk potentials consequently lead to decisions on strategic issues, such as the building of a new data centre or endeavours towards outsourcing of IT capabilities. In this respect, IT governance provides roles and responsibilities, such as Chief Risk Officer (CRO) along with a dedicated security expert (e.g. Chief Security Officer, CSO) to ensure that IT risk management concerns are sufficiently addressed.

So far, approaches that can be found in Swiss hospitals dealing with the involvement of IT at the management level are performed on a case-by-case basis, representing disorganised issues rather than standardised and well-established processes. Differentiating these findings in more detail, it has become obvious that private hospitals, in comparison to public hospitals, have increasingly recognised the strategic importance of IT, since all of the private hospitals surveyed had IT strategy committees in place, which either report directly to the hospital board of directors or to the CEO (see Figure 2).

Figure 2 depicts the six IT GRC areas according to public and private hospitals.
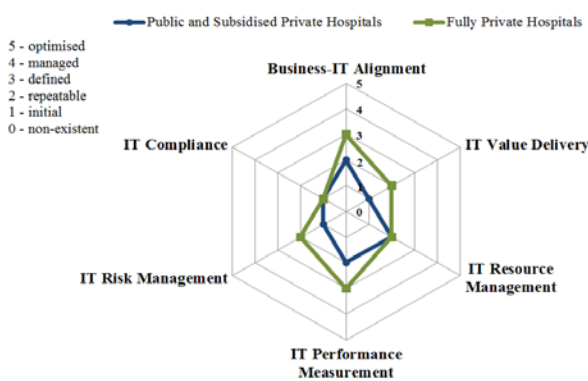
Figure 2.   Comparison of IT GRC capabilities

The study revealed that tasks related to IT value delivery are rudimentarily performed considering only priorities within given budgets. Furthermore, the assessment pointed out that roles and responsibilities have not yet been assigned, resulting in making the CIO responsible for this issue in nearly two-thirds of the hospitals surveyed. It is mentioned that most projects are cross-financed by business, management, or global IT,

making a clear statement on the value proposition of a new solution throughout the delivery cycle desirable. With the help of an established process, it would be possible to draw quantifiable conclusions on IT innovations and their added value for all clinics and organisational units.

Although hospitals are aware of a need for change and signs of improvement have been realised, the idea of business-IT alignment has not yet been fully implemented in most hospitals. However, the findings indicated that, overall, private hospitals are more open to the integration of business and IT, thus, confirming the strategic importance of IT implementation as being a challenge management needs to tackle.

5. DISCUSSION AND IMPLICATIONS

Although the hospitals are aware of the demand for change and reorganisation, even little evidence for improvement can be realised as related studies that have been conducted nationally and transnationally have concluded that IT GRC principles are still less marked in most hospitals today [17; 12; 15]. The findings pointed out that reasons for a less pervasive spread of managed IT GRC can be structured into four main categories representing the greatest barriers to a successful convergence of integrated IT GRC:

- Lack of expertise (limited knowledge, methodical and technical support for IT GRC principles, etc.)
- Lack of resources (budget constraints, limited personnel resources, focus on medical processes, etc.)
- Lack of motivation (perception of insufficient benefit or demand, unfavourable ratio of costs and benefits, individual and organisational resistance to changes, less pressure generated by guaranteed funding by the cantons, missing competitive constraints in the hospital market, etc.)
- Uncertainty regarding the reputation of IT (business priorities are in the foreground, complexity of business processes, cost-centre, etc.)

Although only obstacles were identified in the survey, they provide valuable insights but do not claim to be complete. Still, it can be assumed that the barriers to overcome and dependencies between the obstacles are much more complex. However, the obstacles to overcome are not limited to technical issues, but they also include to a great extent social (interpersonal and socio-cultural), organisational, legal, and even political dimensions.

This implied demand for integration corresponds to the traditional organisation of the hospital as a separation of politics and competences according to medical functions. In the past, this has led to a monolithic information island with a great number of point-to-point connections between vast amounts of specialised applications throughout the hospital, presenting the prevailing fact that hospitals are still not considered one entity, but rather as fragmented units, which are almost

entirely autonomous acting entities with departmental objectives, budgets, and personnel responsibilities.

There are several reasons why the role of IT in health care in general, and in hospitals specifically, is supportive, rather than enabling. Based on the previous discussion, the following challenges to IT and related concepts, such as IT GRC in health care are identified, providing a valuable source for future discussions about the requirements for the adoption of IT GRC in the hospital environment [25] (p. 213); [32] (p. 39).

Considering the increasing expectations of IT from inside and outside the hospital, it is anticipated that in the near future there is the danger of IT becoming unintentionally complex. Therefore, a systematic management of assets, systems, and stakeholders are essential to the overall effectiveness of the IT, and this has, consequently, a direct impact on the performance of clinics and institutes, quality of care, and patient safety. In addition, the ongoing awareness of the patient's needs, the consideration of legal aspects, security issues, and potential threats make the hospital a sensitive field for the adoption of new technologies and concepts. Hence, hospital IT executives must find a balance among many competing priorities, such as reducing operation costs, enabling the hospital to adapt effectively to changing needs, ensuring security and continuity of medical, nursing, and administrative processes, and improving the overall hospital performance while increasing patient and employee satisfaction. These issues make the demand for integrated IT GRC in hospitals a permanent subject on the board's agenda. It is, therefore, the hope of the author of this work that the research results are considered meaningful contributions to the field of IT GRC in the hospital environment.

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