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HOW TO SUCCESSFULLY APPLY CRITICAL SUCCESS FACTORS IN HEALTHCARE INFORMATION SYSTEMS DEVELOPMENT ? A STORY FROM THE FIELD

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HOW TO SUCCESSFULLY APPLY CRITICAL SUCCESS FACTORS IN HEALTHCARE INFORMATION SYSTEMS DEVELOPMENT - A STORY FROM THE FIELD

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Abstract

Many studies have focused on retrospectively identifying critical success factors (CSFs) for healthcare information system (HIS) development projects. In this paper the central question is how in advance selected CSFs can be applied in the best way. An action research study has been carried out in a large Swedish healthcare organization during 2010 and 2011 where the application of four CSFs has been planned, documented and reflected upon. Challenges are identified that may arise when tailoring general CSFs to situational circumstances. For example, the self-evident CSF of "having a clear and accepted objective" becomes tricky and complex in practice when facing 15 autonomous boards that all need to support the project. Similar insights are gained for other CSFs. More research is needed to illuminate the complexities of how to apply CSFs. Another important observation is that different CSFs strengthen one another, which implies that they should be applied and analysed in concert rather than isolated. Finally, healthcare practitioners need to be aware that CSFs are very helpful, but that tailoring general CSFs to the unique situation of the HIS development project requires much effort and continuous reflection from a holistic perspective embedded in systems thinking.

Keywords: Critical Success Factors (CSFs), healthcare information systems (HIS), systems thinking, adoption and diffusion of HIS.

1 Introduction

Healthcare information systems (HIS) are a precondition for secure and effective healthcare as they are an integral part of care processes and documentation processes (Chaudry et al, 2006). The development of information systems (IS) has proved to be challenging, both in general (Alter, 2008; Hevner, 2004) and in healthcare specifically (Dixon-Woods et al., 2011; Heeks, 2006). The underlying cause for development and implementation difficulties and failures is the inherent complexity when technological, social and organisational factors interact (Alter, 2008; Poole and deSanctis, 1994), both in the IS to be designed and in the IS development process. Innovation implementation is known to be extremely challenging in healthcare organisations (Hellström et al, 2010; Nembhard et al, 2009). Whereas features like the complexity of the organisation, the diversity of stakeholder interests and the autonomy of the workforce may not be unique for healthcare organisations, the combination, volume and extremity of these features makes healthcare a more challenging environment for IS development than most other service organisations (Nembhard et al, 2009).

One approach to deal with the complexities in the design process and the HIS to be developed is the application of Critical Success Factors (CSFs). CSFs are: "*the conditions that need to be met to assure success of the system*" (Poon and Wagner, 2001, p. 395). However, the value of CSFs has been questioned. Axelsson et al (2011) argue in line with Berg (2001) that CSFs may be over-simplified solutions that are difficult to realize in practice. For example, a well-known CSF in IS development projects is "top management support". Knowing this is one thing, but actually utilizing this knowledge and obtaining to management support in a specific HIS development project may be difficult. In this application process the CSF itself may give only little guidance. Similarly, Remus and Wiener (2010) argue that CSF research often is limited to the identification of CSFs (retrospectively). Only few researchers focus on the analysis, application and management of these CSFs when used in specific settings (prospectively). In summary our conclusion is that CSF research often concludes "what" CSFs to apply, but seldom discusses "how" to apply them under situational circumstances.

The goal of the paper is to create insight in *how* CSFs can be applied when facing challenges in adoption and diffusion of IS in healthcare. An action research approach was chosen to gain theoretical and practical knowledge about application of CSFs in a HIS development project in a large Swedish healthcare organisation (section 2). Points of departure for the action research study are systems thinking as well as an extensive literature study that identified four CSFs (section 3). The core of the paper is a rich description of how the four CSFs have been applied in the studied HIS development project (section 4). The analysis of the CSF application (section 5) reveals three main contributions of the paper (section 6). First, it is concluded that the way how the CSFs have been applied clearly contributed to making the project a success, although the CSFs by themselves were far too simplified to grasp the development opportunities and challenges that had to be dealt with. Secondly, the interaction between CSFs is identified as being important, whereas current research often studies the value of each CSF in isolation. Thirdly, some lessons learnt for healthcare practitioners are derived focusing on "how to" apply these four CSFs, rather than just stating that they should be applied.

2 Action research design

This section contains a discussion of our research approach and data collection and data analysis methods. In addition the HIS development project that is central in our study is introduced.

2.1 Action research approach

Action research is a research method that aims at obtaining the dual outcomes of action (change) and research (understanding). As an interventionist method, action research allows the researcher to test a

working hypothesis about the phenomenon of interest by implementing and assessing change in a real world setting (Lindgren et al, 2004, p. 441). The phenomenon of interest in this case is how to apply CSFs aiming to develop a successful HIS. By analysing discrepancies between the hypothesized and actual changes in the real-world setting, the action researcher gains both theoretical and practical knowledge about the phenomenon (Lindgren et al, 2004; p. 441). Five typical phases can be discerned (Lindgren et al, 2004; Susman and Evered, 1978): 1) Diagnosing, 2) Action planning, 3) Action taking, 4) Evaluating and 5) Specifying learning. Definitions of each phase follow in sections 4 and 5.

2.2 The Referral and Answer project

The case is part of a HIS development project, performed in the Region of Västra Götaland (VGR) in Sweden, concerning the process of referral and answer. The Referral and Answer project (RA project) aims to ensure patient security by implementing a standardized way of working and information content that support the referral process for all types of referrals. Goals to achieve this aim include developing and implementing a VGR common regulations book, a desired common and unified VGR referral process as well as a common VGR IT solution. The first two goals, and an accompanying goal of getting people motivated and positive to the RA project, were central in the part of the RA project analysed, hereafter called the RA subproject (RASP). RASP started in the autumn of 2010 and ended on 6 October 2011, and is in the early stages of the larger RA project. RASP achieved its goals and is regarded as really successful. This paper discusses how applying CSFs contributed to this success.

The project team of RASP consisted of three project team members. Two of them have healthcare education and extensive experience in healthcare work, but are now working as Operations Controller respectively Development Manager in two different administrations in the VGR. The third project team member has a PhD in Data and Systems Science, has worked in VGR since March 2010, and is the first author of this paper. Table 1 gives an overview of the main activities in RASP, for each phase of the action research method. RASP's background is in more detail discussed in section 4.1 as part of the diagnosing phase of the action research method.

Phase & Period	**Activities in RASP**
Diagnosing Sep. - Dec. 2010	Interpretation of RA project's aim in relation to RASP, Context analysis, Identification of stakeholders, Selection of CSFs
Action planning Sep. 2010 - Jan. 2011	Design of RASP's aim and goals, way of working, structure, activities, timeline
Action taking Nov. 2010 - Oct. 2011	Gaining and maintaining commitment for RASP from stakeholders, Developing Referral process in 40 meetings of 3 hours, Compile and analyse material in between meetings, Continuously showing progress and preserve support from steering groups, Getting commitment for the final solution
Evaluating Nov. 2010 - Oct. 2011	Monitoring level of commitment for different stakeholders Monitoring progress in achievement of RASP's goals Ratification of RASP's output by formal decision in October 2011
Specifying learning Sep. 2010 - Oct. 2011	Continuous reflection on the contribution of the four CSFs

Table 1: Overview of project activities in RASP per action research method phase

2.3 Data collection and data analysis methods

The four CSFs that have been applied in RASP were identified in a literature study (see section 3). A literature review creates a firm foundation for theory development (Webster and Watson, 2002). Data collection in RASP is based on the participation of the first author in the project team. During the 13 months regular discussions were held in the project team considering planned actions and interventions, positive and negative effects of these actions and reasons why these effects occurred.

The empirical descriptions in section 4 are based on project documentation and experiences of the first author. The second author participated in analysing the data after the action research study was completed. This served as an external validation related to whether relevant literature was selected on the topics of CSFs and systems thinking, and related to distinguishing between major and minor relevant lessons learned in the analysis of the case study. The four applied CSFs and the action research phases served as an analysis framework, as shown in section 4 and 5. To validate the correctness of the analysis, the paper has been shared with the other two project members in RASP.

3 Points of departure

Systems' thinking was used as an underlying theoretical foundation. Healthcare organisations are complex systems. A system is "… *an assembly of elements related in an organized whole*" (Flood and Carson, 1993, p.7), which in turn relate to other systems (Avison and Fitzgerald, 1998). Hence, an element cannot be released from the whole and changes in one element influence the whole system as well as other systems. The degree of complexity increases with the number of elements, relations and levels as well as when people are included in the system. Systems' thinking is a way to understand and manage complexity by adopting a holistic approach. This includes studying and understanding things from the three levels of inquiry (why, what, how) as described by Van Gigch (1991).

CSFs should consist of a limited number of factors (Rockart, 1979). When too many success factors are selected (e.g. more than 4 to 6), they are probably too detailed and not all of them may be critical (Avison and Fitzgerald, 1998). In an extensive literature study of on CSFs in IS development (Aggestam, 2004) four overarching CSFs were identified from a large number of more detailed CSFs. Recent studies of Nasri and Sahibuddin (2011) and Marcks von Wurtenburg et al (2011) confirm that the CSFs identified in 2004 still are central and relevant. The four CSFs applied in RASP are:

CSF1: To learn from failed projects: Organizations must learn from their own experiences and not make the same mistakes over and over again (Lyytinen and Roby, 1999; Ewusi-Mensah and Przasnyski, 1994). This relates to Axelsson et al (2011) stating that adaptation to context is important.

CSF2: To define the system's boundary, for the whole system and for relevant subsystems: The system's boundary concerns the business border. It constrains what needs to be considered and what can be left outside (Van Gigch, 1991). Only if the organization as a whole is clear about its aim and works on a principle of shared values can small units be allowed to take responsibility for running themselves (Barlow and Burke, 1999).

CSF3: To have a well-defined and accepted objective aligned with the business objectives: A successful IS should meet agreed upon business objectives (Ewusi-Mensah and Przasnyski 1994, Milis and Mercken 2002). An organization should be examined from different perspectives (Pun 2001) which in turn is a prerequisite for defining the goal. Commitment from management is crucial if the project affects a large part of the organization (Milis and Mercken, 2002).

CSF4: To involve, motivate and prepare the "right" stakeholders: How well an IS will work in an enterprise depends on the user involvement in the development process (Cherry and Macredie, 1999;; Browne and Ramesh, 2002). The success of this involvement depends on how well people work and communicate (Saiedian and Dale, 2000).

4 Application of CSFs in the Referral and Answer project

In this section RASP is described chronologically, roughly following the first three phases of the action research method: Diagnosing (4.1), Action planning (4.2) and Action taking (4.3.).

4.1 Diagnosing

Diagnosing refers to the joint (researchers and practitioners) identification of situated problems and their underlying causes (Lindgren, 2004). One of the challenges the RA project must overcome is the size and accompanying complexity of the healthcare organization VGR (www.vgregion.se). The region Västra Götaland has 1.5 million inhabitants and the area is from north to south 300 km and from west to east 250 km. VGR is among other things responsible for providing the inhabitants of Västra Götaland with the healthcare and medical treatment that they need. There are approximately 45000 employees working in 17 hospitals, 121 healthcare centres and 170 public dental care centres. Some care is provided by private centres that have a contract with VGR. VGR uses the client-contractor model. Healthcare is organized in 15 autonomous administrations, e.g. each hospital and each administration of healthcare centres with their own board, controlled by an administration manager. This autonomy causes the need to work with agreements between the administrations.

Earlier referral projects did not achieve their aims and the experience from another recent high stake VGR IT project was among many stakeholders regarded as negative. One of the contributing factors has been that not all the 15 administrations had been involved in these earlier projects.

The RASP team received their assignment from the RA project steering group. One person in the steering group has the role of being a "contact person" for the RASP team. The contact person has a strong position in the steering group. Furthermore, the contact person is a doctor with long career in VGR, both as medical Director and administration manager. She has even a strong position and a very good reputation in the larger VGR organisation and is regarded as a trustworthy person.

In parallel with the RA project a National eReferral project was planned. Decisions and results in National eReferral were something that RASP would have to keep up with since VGR's process and rule book must be in line with national rules. Also, in a large organisation like VGR, several other HIS development projects are always running that might at some point interfere with RASP.

4.2 Action planning

Action planning is the process of specifying the actions that can improve the problem situation (Lindgren, 2004). The four CSFs described in chapter 3 were introduced in RASP by the first author. Although the CSFs originated from a literature review, they matched the circumstances at the start of RASP quite logically. The negative experiences with previous projects relate to CSF1. The complexity of the large organization and the existence of several related on-going other HIS development projects relate to CSF2. One of the observed failures in previous projects was the lack of involvement of stakeholders. The three project team members and the contact person had a strong preference for IS development by means of a participatory approach, which made this development strategy a natural choice, in accordance with CSF4. A requirement for project management in general and for a participatory approach specifically is a clear and accepted objective. That requirement, combined with a complex organisation involving many stakeholders with different interests, relates to CSF3.

From a holistic view, the project was designed based on all the 4 CSFs. However, in the beginning there was a strong focus on CSF4, e.g. how to involve and motivate the right stakeholders by means of a participatory approach. This desired way of working had to be committed by the project's steering group and by top management in both VGR and in the administrations. In this anchoring the contact person was intended to play an important role.

In an organisation with 45000 employees it is impossible to work together with everybody. At the other hand, it is critical to involve both management and people working in the healthcare process. Figure 1 shows how RASP's participatory structure was organised and communicated. The RASP team was dependent on each administration's interdisciplinary group. A RASP administration manager was a person in the administration's management team, who would be nominated by the administration manager. To be a RASP administration manager was to be responsible for the

Administration's interdisciplinary group, work at their "home administration" creating commitment for the RASP project and motivating for participation (CSF4). The RASP administration managers would help to identify the "right" stakeholders (CSF4) and act as champions for RASP.

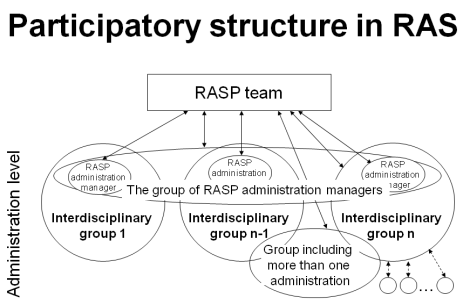

Figure 1: How the participatory structure of RASP was illustrated

To involve and motivate the stakeholders (CSF4) requires an accepted objective (CSF3). Accepting the objective requires knowledge and understanding of *why* this is important, as follows from Van Gigch's three levels of inquiry (1991). Hence, a lot of effort was made to collect and put together facts and figures that revealed the problems in the referral process from a patient security perspective and to describe three real patient cases in order to relate the figures to recognizable work situations. The following patient citation was used in all meetings aiming to remind everyone involved why RA was performed to create a sense of urgency: "*That one needs to wait several months to get an appointment and an answer; it is anyway my life that is ticking away*".

A consequence of our continuous efforts of emphasising the "business objective", i.e. patient security, was that already during the planning stage the RA project changed from an "IT-project" governed by the IT department to a "Development project with IT-support" governed by the healthcare department. This decision was taken with support from the steering group. Later on in the project, when scepticism arose against "another IT-project" or when we faced opinions that "an IT-tool is the only thing that we need to solve this", it proved that this different character of the project helped us to motivate and explain how important the development of work processes is.

CSF1, to learn from failed projects, was dealt with integrated in our work with CSF3 and CSF4. As one of the main lessons learned was the lack of involvement of the 15 administrations, especially in early stages, the choice for the participatory approach was a way of learning from earlier mistakes.

From the perspective of CSF2, relations with the national eReferral project and other local HIS projects were analysed, aiming to identify what belonged to RASP and what not. It was realised that if RASP would try to solve everything, nothing would be solved. On the other hand, it was important to continue monitoring these dependencies. Two RASP team members joined the important workgroup for the national eReferral project. This was however not a realistic strategy for all other projects.

4.3 Action taking

Action taking refers to the implementation of the intervention specified in the action planning phase (Lindgren et al, 2004). During implementation three main activities can be discerned. First, it was necessary to get commitment for the proposed way of working. Secondly, the Referral process and rule book were developed together with stakeholders in a series of meetings. Thirdly, the final agreed upon outcome needed to be formally ratified and informally anchored.

The first step was getting commitment and understanding for *why* RASP wanted to work in a participatory approach. When explaining and motivating the way of working, the four CSFs were

explicitly used. The critical importance of CSF4 was stressed by referring to well-established research. Commitment had to be obtained at different management levels, first in the steering group and then in VGR's top management where all administrations were represented. Here, the contact person played an important role. When discussing the proposed participatory structure, the importance of having a RASP responsible person in each administration was clarified. The contact person received the important promise from VGR's top management that each administration would nominate a RASP administration manager.

The first meeting with the group of RASP administration managers was regarded as both the last preparation activity and the first intervention activity. If they would not have committed themselves to the aims of RASP and the intended way of working (the participatory approach), everything would have been needed to re-plan. The participation of the contact person in this meeting had a strong symbolic value. The presence of CSF3 and CSF4 are clearly recognizable in the presentation given at this meeting, including the collected facts concerning problems in the referral process (CSF3) and arguments how working in a participatory approach helps to create better understanding of the Referral process and how it contributes to commitment and motivation (CSF4). The comment "*Are we included already now?*" illustrated that the RASP administration managers were not used to being involved so early. The RASP administration managers accepted their role and gradually became an informal steering group.

In this first meeting with the RASP administration managers one of them raised the question "*Why shall we succeed this time?*". When evaluating the meeting it was felt that the answer of the RASP team was not satisfactory. It triggered the observation that CSF1 had been hidden in the work with CSF3 and CSF4. Also, lessons learned from earlier projects were based on stories and assumptions, rather than facts from actual analysis of earlier projects. After examining earlier referral projects and after discussion the findings with the contact person, the main differences between the RASP approach and the former way of working were highlighted. This overview was presented by the contact person at the second meeting with the RASP administration managers. Besides the participatory approach, other important differences were a stronger focus on work process rather than only on IT, involvement of all administrations and that the result of RASP had to be ratified formally on the highest level.

The development activities consisted of three series of meetings, where each series had a different sub goal. The first round of discussions focused on current referral processes and desired changes. The second round consisted of collaboratively identifying the new common Referral process. The final round involved collecting feedback on the proposed new Referral process and further refinement of it. It is important to highlight that in this final round the group constellations were changed to purposively lift the evaluation discussions to a cross-administration level perspective. Besides modelling work, time was spent on maintaining commitment in the interdisciplinary groups, as well as anchoring the project's progress on a higher level by informing and collecting feedback from the formal and informal steering groups. In total, 40 development meetings of approximately 3 hours were conducted. In addition, both in the various administrations and in the RASP team, synthesizing and preparation work (e.g. collecting knowledge concerning the referral process) was done in between all the meetings. The RASP team also continuously reflected on the results of each meeting and the effectiveness of the participatory working approach.

While RASP shifted from action planning into action taking phase the related National eReferral project had started. The interface between the national project and the local RASP was continuously analysed in order to identify relations and to help us defining the right focus for RASP. Figure 2 shows how this on-going dependency analysis activity was communicated to the working groups. Our attention for system boundaries (CSF2) helped us to identify and address misunderstandings that the national project would strongly define and limit what was allowed to include in the local RASP, leaving less room for local initiative, which was in strong conflict with the participatory approach (CSF4). In contrast, the dependency analysis work helped our steering group to nominate appropriate VGR-representatives in National eReferral to proactively give input from VGR's perspective. The other way around, referral process development in RASP is adapted to decisions in eReferral.

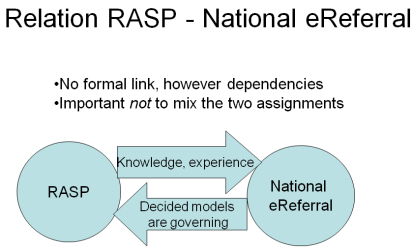

Figure 2: How the relation between the two projects was communicated

When developing the new Referral process collaboratively with all administrations, deficiencies in the existing rule book are discovered. Instead of seeing the rule book as a "given" prerequisite for defining the referral process, the holistic thinking CSF2 revealed the reciprocal relationship between rule book and referral process. Consequently both became "object of design" and were included in the same document, showing that a new process automatically implies a new version of the rule book.

The three levels of inquiry (Van Gigch, 1991) helped us to formulate and get commitment for goals (CSF3) on different levels. To enable every administration to accept the final developed process, it must be serving the overall goal of patient security on the why-level, it must be specified and described on the what level, and it must leave the how level open for local implementation adaptations. As put by one RASP administration manager: "*How we take us from A to B is our own responsibility*".

All administrations act in both roles as sending the referral and receiving it. However, often the healthcare centres act as sending unit and the hospitals act as the receiving ones. To get agreement on these interfaces between administrations, the last series of meetings was conducted in inter-sectorial groups, to discuss implications when both roles were represented. Role switching was used as technique to counteract opinions based on "we and them"-values. This was another step in the on-going effort of obtaining a common accepted objective (CSF3).

The final acceptance and decision activity aimed at getting the developed referral process as well as the revised rule book established. It involved several presentations for various management groups by our steering group contact person, as well as personal dialogue between her and selected decision makers. While the major part of the explanation and anchoring already was done during the implementation activities, as a result of the participatory approach, the result of RASP was already more or less accepted before each meeting.

Finally, the formal ratification of the new referral process and the new version of the rule book by the Director of Healthcare at the 6th of November 2011 completed RASP. Of course, some of the discussed activities are continued in the next stage of the larger RA project.

5 Analysis and discussion of lessons learned

In this section the outcomes of the action research method phases evaluating and specifying learning are presented together as they are so interrelated. Evaluating entails the joint assessment of the intervention by practitioners and researchers, while specifying learning denotes the on-going process of documenting and summing up the learning outcomes of the action research cycle in the form of knowledge contributions to both theory and practice (Lindgren et al, 2004).

Table 2 summarizes for each CSF the main actions and observations in each phase of the action research method. The construction of this table has been invaluable in deriving the main lessons learned for practitioners and scientists. The main lessons learned are discussed hereafter.

Table 2: Overview of CSFs across action research method phases

	CSF1	**CSF2**	**CSF3**	**CSF4**
Diagnosing	START: Too strong technology focus Issues regarding CSF 3 & 4 HALFWAY PROJECT: RASP initially poorly explained what exactly was learned from earlier projects	Large, complex organization Responsibilities for decisions and implementation on different levels Related on-going HIS development projects locally and nationally	Large organisation with many different interests Highly respected contact person Lack of formal decisions on earlier project results Interrelation with CSF4	Not all stakeholders represented in earlier projects Large organisation with many different stakeholders Team and contact person prefer participatory approach Interrelation with CSF3
Action planning	START: Build image that RASP is not about technology Actions related to CSF 3 & 4 HALFWAY PROJECT: Creating highlights of differences with earlier projects	Understanding the system's structure and behaviour Define clear responsibilities for decisions /implementation Analyse relations with related projects Compile groups with representatives from different parts of the organisation	Use contact person to identify where commitment is needed Goals on the why and what level, not on the how level Compile facts and patient examples to illustrate referral problems aiming to enhance acceptance Actions related to CSF 4	Design participatory structure to enable participatory approach Also the way of working needs to get accepted Invite RA managers with high status and let them select representatives on next level Actions related to CSF 3
Action taking	START: Present facts and statistics on importance to first focus on work processes, then on IT HALFWAY PROJECT: Presenting highlights in group of RA managers	Present decision making responsibilities and project dependencies for participants Participating in 9 2-day meetings of national eRferral Create cross-administration view in development process	Use of the contact person to get commitment at many different levels Facts and examples create sense of urgency Maintaining commitment is supported by CSF 4 actions	Early involvement of all administrations Patient citation and project aim repeated in each meeting Transparency of progress contributed to willingness to participate
Evaluating Specifying learning	Explicit communication of what is done different and why important from start Learn not only from failed or in-house projects, also from successful and/or external ones Draw lessons from projects that have had a high impact for important stakeholders	Systems thinking is hard, risk that holistic focus is lost when involved in details Focus on system interface rather than system boundary The three levels of inquiry (why, what and how) have been very helpful Understanding system helps managing CSF 3 and 4	Utilize people with good context-knowledge regarding where to anchor the project Utilize people with high impact to obtain commitment Maintaining commitment is an on-going effort Well-defined involves goals formulated on different levels of inquiry (why, what, how)	Not only goals, also way of working needs commitment Involvement requires a structure that enables and allows involvement Maintaining commitment is and on-going effort Utilize representatives with high impact to motivate people

The action research study shows how the four CSFs, both individually and in concert, contributed to the success of the RASP project. However, as suggested by several authors (Berg, 2001; Remus and Wiener, 2010; Axelsson, 2010), and confirmed in this study, it is important to adapt CSFs to situational and contextual factors. *It may be prescribed in general "what" CSFs need to be applied, but it cannot be prescribed in detail "how" CSFs should be applied.* Awareness is needed that tailoring CSFs to situational circumstances in HIS development is a hard and time consuming process.

The study also illustrates the strong interactions between the different CSFs, implying that CSFs should not be treated as "isolated interventions". As RASP evolved, the insight that the four CSFs interact and strengthen one and another emerged more and more. Previous failures (CSF1) served as argument for applying a participatory approach (CSF4). This participatory approach (CSF4) helped to uncover differences in goals between stakeholders (CSF3). Analysis of the larger system and subsystems (CSF2) helped to relate individual goals to the common objective (CSF3). A common objective, accepted by all different stakeholders (CSF3) created and maintained motivation to participate in the process (CSF4). The interaction between CSFs has implications for how they need to be managed over time. Although the analysis shows that there was more emphasis on certain CSFs at certain stages, *all CSFs need to be addressed continuously*. This implies that when one CSF is at the forefront, others still support this one. So, given situational interests, the overall intentions of the different CSFs may be achieved more effectively be letting the "hot" one paving the way for the others. Shifts in application strategy over time are hard to plan; instead they emerge by situational adaptation to circumstances monitored. Although others have indicated in retrospective analysis that CSFs might be interacting (Akkermans and van Helden, 2002) or differ in relevance in different project stages (Remus and Wiener, 2010), studies like this *discussing how and why CSFs are related when applied prospectively* are rare and strongly needed to develop a more in depth understanding. The fact that CSFs were applied from a holistic perspective as part of a systems thinking approach has helped to reveal the interrelations between the CSFs. *The adoption of systems thinking, including three levels of inquiry, has in this way contributed to making RASP a success story.*

Learning from failed projects (CSF1) actually addresses the sensitivity for historical situational context in the organization performing the HIS development process. When applying this CSF it is important to also take into account previous successes, not only failures. Also, it is especially important to look at earlier projects/experiences that have had high impact in the organization. Finally, *it is crucial to clearly communicate how this affects the current project*, e.g. what is done differently. When defining the system's boundary (CSF2) the boundary itself should not be interpreted as a border that should not be passed. Rather, it is an invitation to start investigating and exploring what is outside the project and how the environment can be influenced or how it impacts us. Setting a boundary is thus creating more work (monitor and analyse dependencies) rather than less (ignoring what is outside the boundary). This means that *the focus should be on interfaces*, rather than boundaries. Besides having one general well-defined and accepted objective, aligned with business objectives (CSF3), *this general objective should be "translated" in many different objectives on many different levels* to connect to the different interests of all involved stakeholders, which might include top management, line-managers, professionals with high status (e.g. doctors in healthcare), et cetera. Involvement and commitment of stakeholders (CSF4) should not only be created, but also maintained. Also, as it is impossible to involve everybody, you need to initiate a snowball effect by a network of strategically chosen champions, who carry the message of the project to those employees the project team inevitably never will meet. Also, *commitment has to be obtained for many different things over time, e.g. sense of urgency for the problem, problem definition, objectives and goals of the project and the way of working in the project.* Failure on one aspect may influence overall commitment.

Finally, a general lesson learned was that it is not sufficient if only the project team itself analyses and understands the CSFs. *Crucial for success is to communicate the reasoning behind why a specific way of working or intervention is chosen.* This implies explaining the use of CSFs in different stages of the project and obtaining commitment for their situational application. *Managing CSFs is a continuous process* as interests and goals are not static over time.

Analysing the HIS development process from a CSF perspective has been one way to obtain a deeper understanding of change and implementation challenges. By applying other analysis perspectives in future work an integrated theory for HIS development can be built including insights from for example CSFs, championing, empowerment, management of interactive processes, structuration theory and systems' thinking. Healthcare organisations are fruitful research settings for this theory building given their challenging nature; can IS development be mastered here, that method may work anywhere.

6 Conclusions

The goal of this paper has been to create insight in *how* CSFs can be applied when designing and performing a HIS development project in order to overcome difficulties and challenges in adoption and diffusion of IS in healthcare. Hence, the main contribution of our research is a very rich description of *how, in advance selected CSFs, successfully were applied and tailored to the unique context of a HIS development case*. Two important conclusions are that:

- the analysis of our action research study *confirms* that it is important to adapt CSFs to situational and contextual factors;
- the analysis also *reveals* that there exist strong interactions between the four CSFs applied, which implies that CSFs should be analysed and applied in concert rather than in isolation.

Future research studies should focus more on "how to" apply CSFs and "how to" tailor general CSFs to situational circumstances, rather that the dominant perspective of identifying "what" CSFs to apply. Special attention is needed for the interactions between CSFs when applying them in concert.

Based on our experiences, the following lessons learnt for healthcare practitioners can be identified, focusing on "how to" apply the four CSFs studied, with the reservation that one needs to be aware that local circumstances in your healthcare organisation may ask for additional modifications:

- Be sensitive for situational circumstance, by learning from previous successes and failures; pay extra attention to earlier experiences from high impact projects and stakeholders; and communicate explicitly what will be done differently in the current HIS development project (CSF1).
- Identify, analyse, manage and monitor dependencies by focusing on interfaces with other processes, projects and developments in the environment of your own project, rather than seeing the boundary as a border not to be crossed (CSF2).
- Use collected facts, figures and recognisable work situations to enhance acceptance for the overall objective; translate this objective in many different objectives related to specific interests of different stakeholders; and use role switching and perspective taking to create understanding between stakeholders for their different viewpoints (CSF3).
- Create a participatory structure that enables representation and contributions from all stakeholders; be aware that commitment needs to be created and maintained for many different issues (e.g. problem, objective, way of working); and create transparency about progress by regularly informing and having dialogue with all stakeholders (CSF4).
- Manage all CSFs throughout the whole project period, and monitor and manage their interaction by adopting a holistic perspective embedded in a systems thinking approach, utilising the three levels of inquiry (why, what and how).

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