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A Process Model for IT Migrations in the Context of a Hospital Merger – Results from an Austrian Case Study

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Abstract. In 2016, a new university hospital merged from three former independent Austrian hospitals started its operation. This paper presents a process model developed to coordinate the IT migration after the merger, using five phases to meet the requirements of the specific setting. A methodological mix of interviews, surveys and workshops was applied during the IT migration process. High stakeholder participation and a transparent methodical approach led to a broad agreement on success factors, migration objectives, and evaluation results. Thus, acceptance for the finally selected migration scenario was very high among employees, which is known to be crucial for the success of migration projects.

Keywords. Hospital merger, IT migration, hospital information system, migration scenario.

1. Introduction and Background

1.1. Theoretical Background

In general, several conditions can cause the need for software or information system migration projects throughout various industries and enterprises. Most important are the obsolescence of a technology, the pressure of users to modernize the information infrastructure, or the need to build a single coherent information system after a company merger [1]. Mergers are usually dominated by legal and financial analyses and negotiations, while strategic analysis and planning of holistic organizational integrations are often neglected. Nevertheless, it is shown that substantial holistic analytical and planning activities are important for the long-term success of a merged institution [2]. In fact, studies have shown that among other organizational issues, a poor definition of the new corporate information system and its infrastructure requirements as well as a reluctance to determine the objectives and conditions of the integration process in advance are a significant cause for poor ex-poste performance [3]. Moreover, the IT integration itself is found to be critical for the merger success and improvements in merger planning can often be achieved by including IT staff in pre-merger planning activities [4]. These findings are also applicable in hospital merger settings, where the

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migration of hospital information systems (HIS) and consequently the electronic health record is crucial for the success of the future hospital operation [5].
In fact, only a uniform HIS can ensure that the new organization can exploit the full potential of its high level of IT support and process automation. Previous research shows that HIS provide major benefits in patient care, such as improvements in reporting, organizing and locating clinical information [6] as well as clinical decision support [7], coordination and management of patient care [8], and patient safety [9]. These benefits can only be achieved if the hospital has a coherent and universal HIS in place. In addition, standardized, valid and comprehensive clinical data in hospital information systems are a crucial source for clinical and health outcome research [10].
Even though the benefits of IT integration after a merger are transparent, little is known on how to set up the migration process in a hospital setting in order to ensure an effective IT integration of the HIS. Studies show, that implementing a general process model following the phases of (i) Planning, (ii) Implementation/Integration, and (iii) Review/Evaluation has been effective to structure post-merger IT integration [3].

1.2. Project Background

As a political response to the immanent shortage of medical doctors in Europe in general and in Austria in particular, the Austrian national and Upper Austrian state government decided on the founding of a fourth national school of medicine. This school of medicine was established as part of a newly founded medical faculty at the existing Johannes Kepler University in Linz (JKU) in October 2014.

In Austria, a school of medicine needs to cooperate with a university hospital, which is characterized as a hospital that serves as a whole or in part as research and teaching institution for a medical university or medical faculty. Since Austrian law provides that medical schools and universities can be associated to only one corresponding university hospital [11], state and local governments agreed on merging three formerly independent state and community hospitals belonging to two individual hospital organizations to form a sufficiently large and diverse hospital institution in order to satisfy the requirements of the university in terms of research and teaching resources. Therefore, the Linz General Hospital (AKh), the Women's and Children's State Hospital (LFKK) and the Psychiatric and Neurologic State Hospital Wagner Jauregg (LNK-WJ) were merged to form the Kepler University Hospital (KUK). Table 1 presents several indicators to demonstrate the project size of the merger. When starting its official operation in January 2016, the KUK was Austria's second largest hospital (1,825 beds) with the Vienna General Hospital being the largest (1,990 beds) regarding the indicator "number of beds" [12].

Table 1. Project size of the KUK hospital merger (* in million Euro)

Indicator	AKh	LFKK	LNK-WJ	total
Legal ownership	City of Linz	State of Upper Austria	State of Upper Austria	
Number of beds	886	270	669	1,825
Stationary stays	60,000	19,566	17,894	97,440
Outpatients	275,000	21,107	18,917	315,024
Total spending*	230.6	106.5	143	480.1
Staff	2,838	1,142	1,838	5,817

In addition to the challenges arising from the merger of the different legal and cultural environments of the three hospitals as well as the requirement of adding teaching

and research tasks in many departments that were until then oriented mainly to clinical care, the hospital management had to face the fact that two completely different Hospital Information Systems (HIS) were in place in the institutions. Therefore, the migration of the existing HIS systems was a central challenge within the merger project.

In the present case, a committee consisting of members from local politics, the university, the three hospitals, and legal as well as healthcare experts was established to accompany the project in a strategic and holistic way. The objective of the merger was to create a new hospital, so in terms of the strategic goals from an IT perspective, this objective was adopted in a very early state. Therefore, the main objective of the IT migration was defined as follows: *The KUK will offer an highly effective IT support for all users working in clinical care, administration, research, and teaching, and this highly effective IT support will be realized through the merger and standardization of information and communication systems from the three former hospitals.*

Since time and cost constraints of the merger and IT migration project were accordingly tight, an accurate and specially adapted process model for the migration of the HIS of the KUK was needed. Existing studies on process models for IT migration projects are often focusing rather abstractly on high-level process phases without explaining details on specific methodologies or milestones [3]. Others tend to concentrate on detailed technical procedures [13]. Therefore, the research goal was to develop and apply a customized but still generic process model for IT migrations after hospital mergers, including the selection process of an appropriate future HIS.

2. Process Model and Applied Methods

Evidence shows that in terms of the migration process, several factors are critical in order to achieve a successful migration outcome. Beside thorough IS planning, positive support by the management, and high-quality communication to end-users, also high level of end-user involvement in strategic planning during the process is crucial [14].

In order to address these findings as well as the specific demands and needs of the present situation within the three hospitals, a customized process model was developed by the authors specifically for the current IT migration. When designing the process model, it was essential to describe the phases and methods in a generic way so that the model can be applied to other migration projects in similar settings. The model consists of five phases:

- Phase 1: Definition of migration objectives, identification of basic conditions
- Phase 2: Evaluation of the IT infrastructure in the former individual hospitals
- Phase 3: Development of migration scenarios, selection of one scenario
- Phase 4: Design of a project plan, installing of operational teams
- Phase 5: Implementation of the IT migration

The migration and research project started in January 2014. At the time the present paper was written, phase 1-3 were successfully completed. Furthermore, phase 4 and 5 focus on standardized project planning and realization procedures. Therefore, in the following the paper focuses on the presentation of applied methods, findings and lessons learned from the first three phases.

2.1. Phase 1: Definition of migration objectives, identification of basic conditions

The main objective of phase 1 was to set the basic framework for the following migration process. With regards to the findings of Robbins and Stylianou [14] concerning critical factors identified for successful migrations, end-user involvement as well as end-user communication and support by the hospital management were thoroughly pursued in order to defining overall IT objectives for the migration process as well as identifying basic migration conditions. Starting point for the investigations was the identification of HIS key factors for the success of IT support along clinical care as well as clinical research processes.

To reach the objectives above, phase 1 was structured into seven process steps applying the methods interview, survey, and world café as shown in Figure 1.

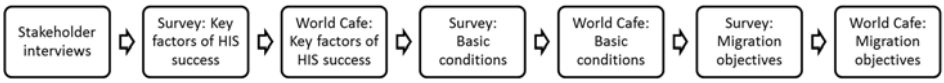

Figure 1. Process Steps of Phase 1.

Initially, stakeholder from various professional groups within the three hospitals were identified and divided into the following stakeholder groups: (i) clinical care and hospital management, (ii) research and teaching, and (iii) IT provider. Then, a total of 35 structured interviews were conducted with members of all three stakeholder groups. The aim of the interviews was to get a broad understanding of expectations and concerns regarding the IT migration process, of perceived key factors influencing the success of the future HIS, and of subjective IT migration objectives. In total, more than 50 hours of interviews were conducted, resulting in over 280 pages of transcripts.

A content analysis was conducted to identify a consolidated list of perceived key factors for the IT success in the new hospital, basic conditions for the IT migration as well as potential IT migration objectives. These findings form the basis for the subsequent surveys and workshops.

In three rounds each starting with a survey followed by a World Cafe workshop 37 members of all stakeholder groups were invited to evaluate, rate, and comment on the findings of the initial interviews. User participation was high (survey response rate between 89.9 and 94.6 percent) and the working atmosphere during the workshops was very constructive with management and clinical care personnel working in partnership of equals when agreeing on the main key factors, conditions and objectives.

In phase 1, a total of 52 key factors for HIS success, 35 basic conditions for the IT migration process and 22 IT migration objectives were identified, defined, rated and commented.

2.2. Phase 2: Evaluation of the IT infrastructure in the former individual hospitals

The aim of phase 2 was to determine the gap between the IT migration objectives defined in phase 1 and the current IT status within the three hospitals. The results of phase 2 were an important input for the development of detailed migration scenarios and subsequently a project plan. The analyses of the IT landscapes and IT infrastructure within the three hospitals were conducted by independent healthcare analytics as well as healthcare IT consultant companies and accompanied by the research team. First, an internationally

accepted score measuring the maturity of the existing HIS in all three hospitals was determined [15]. Second, more detailed analyses of the functionalities and technical abilities of both HIS were performed. The areas analyzed and categorized were based on an IT capability model developed by the consulting company referring to the following domains: (i) strategic alignment of IT, (ii) IT governance, (iii) architecture management, (iv) solution development, (v) service management and operation, (vi) IT security, (vii) human resource and knowledge management.

Finally, clinical and administrative processes commonly supported by a HIS were analyzed, including administration, planning, care support, as well as research and teaching. Finally, the degree to which each IT migration objective defined in phase 1 is already fulfilled in each hospital was determined. In total, 49 interviews with members of various professional groups (IT decision maker, IT provider and IT staff, doctors, and nurses) within the three hospitals were conducted between November 2014 and February 2015.

2.3. Phase 3: Development of migration scenarios, selection of one scenario

Phase 3 was designed to derive various migration scenarios based on the findings of phase 1 and 2, evaluate the scenarios in terms of defined criteria and select the best suitable migration scenario as a starting point for the development of a project plan.

A migration strategy team of 13 people from the following stakeholder groups was formed to complete the tasks planned for phase 3: (i) two strategic IT representatives from both former hospital organizations serving as interim migration managers, (ii) two representatives from medical informatics, (iii) two representatives from the IT provider each servicing one of the two existing hospital systems, (iv) two external IT migration consultants, (v) one representative from the university rectorate, (vi) one external IT manager from a university hospital in Germany, (vii) three members of the research team. The group was responsible for gathering information from the hospitals and the HIS market, involving potential HIS vendors, defining the conditions for the migration scenarios, evaluating the scenarios and finally presenting the findings to the hospital management so they could make a decision on the future HIS as well as the migration process. Due to financial, legal and time restrictions it soon became clear that only one of the two already implemented HIS would be suitable to be extended to the whole university hospital, therefore only two HIS vendors were involved in phase 3.

The development, evaluation and rating of migration scenarios is an extensive and complex task that requires in depth focus and a multi-level approach by a critical amount of strategic key stakeholder and experts that are difficult to be brought together during a time-consuming migration project. Thus, the research team designed a five days intensive workshop bringing together the migration strategy team and up to 20 additional specialists. The first three days were used to further develop and specify two migration scenarios that had been prepared by the HIS vendors, each based on the enrollment and enhancement of one of the two existing HIS for the whole university hospital. On the last two days the members of the migration strategy team developed evaluation criteria for the scenarios using the card brainstorming technique [16]. The initial amount of more than 80 criteria was reduced by removing redundancies and clustering evaluation topics. The remaining 30 criteria were then categorized into three dimensions: HIS evaluation, vendor evaluation and scenario evaluation. Members of the migration strategy team as well as nine until then not involved clinical care representatives from the three hospitals were asked to evaluate the two scenarios with regards to the criteria. Each rater received

90 virtual points that could be assigned to a criteria-scenario-combination being completely free of leaving several criteria unrated. Finally, the external experts, the interim migration manager and the hospital IT provider each conducted SWOT (strengths, weaknesses, opportunities, threats) analyses that were combined to create a transparent picture of the advantages and disadvantages of the two migration scenarios for the hospital management.

3. Results

The main objective in phase 1 was to set the fundamental framework to all following IT migration phases. For this purpose, 35 structured interviews with stakeholders from clinical care and hospital management, research and teaching staff, and IT provider were conducted and analyzed. The content analyses led to 35 basic conditions (e.g. "*Data protection and data security have at least to be sustained at its current level"* or "*Time and financial resources for training have to be provided"*) as well as to 52 key factors of IT success, which were categorized (human/process/system) and evaluated using two dimensions (importance and urgency) on a 1-5 scale (1="I do not agree at all"; 5="I completely agree"; see Table 2).

Table 2. Top 10 key factors sorted by importance (n=34, values are mean values)

Key Factor of IT Success	Category	Importance	Urgency
Sufficient financial resources	process	4,90	4,67
Qualified IT-personal	human	4,81	4,65
Reliability of the IT-systems	system	4,79	4,5
Clearly defined IT-strategy	human	4,79	4,43
Sufficient personal resources	human	4,74	4,63
Trained staff	human	4,73	4,42
Uniform system for patient administration	process	4,67	4,50
Process orientation in IT	process	4,66	4,18
Human success factor	human	4,64	4,36
Maximum risk reduction	process	4,63	4,53

Interview content analyses summarizing and classifying the statements along with further categorization of key factors led to the identification of 22 IT migration objectives. These IT migration objectives were presented to the stakeholders in order to ask for their consent (see Table 3 for selected migration objectives ranked by degree of consent, labeled with date of achievement).

Table 3. Selected key factors and IT migration objectives (*n=33)

Consent (n=34)	IT Migration Objectives	To achieve
100.00	High data security	anytime
100.00*	High reliability in patient related IT systems	anytime
100.00	Informed and IT-trained staff	until 01.01.16
100.00	Realization of IT synergy effects	after 01.01.16
100.00	Uniform HIS	after 01.01.16
97.06	Open IT infrastructure	until 01.01.16
91.18	Investment in sustainable technologies	after 01.01.16
88.24	Use of mobile technologies	after 01.01.16
87.88*	Paperless hospital	after 01.01.16
85.29	Outstanding IT systems for research, teaching and care	after 01.01.16

To determine the gap between the 22 IT migration objectives identified in phase 1 and the current maturity of the IT infrastructure of the three hospitals, a holistic IT evaluation was conducted in phase 2. One aspect of this evaluation was the determination of an HIS maturity level (scale from 0 to 7, with 7 being the highest level [15]). Reaching maturity levels exceeding European average (3.0 in 2015 [17]). For the next level, full clinical decision support and closed loop medication would be needed. Detailed IT evaluations as well as the degree to which the IT migration objectives were already achieved, showed that all three hospitals were at a similar maturity level, providing a solid IT basis for the University hospital.

Table 4. Selection of evaluation criteria sorted by according category (scenario, vendor, HIS)

Evaluation Criteria	Scenario	Vendor	HIS
Controllability of risks	*		
Consideration of organizational and personnel restraints	*		
Customer orientation		*	
Innovative power		*	
Professional and personnel competence			*
Degree of coverage of clinical care processes			*
Enhancing opportunities for cooperation with university hospitals			*
Sustainable investment in terms of technology			*
IT support of research & teaching tasks			*

Based on the results from phase 1 and 2, two IT migration scenarios were developed and evaluated by a migration strategy team formed in phase 3 using a set of 30 criteria to evaluate the scenarios. Each member of the migration strategy team received 90 virtual points that could be split up and assigned to any criteria-scenario combination. The criteria were developed during an intensive workshop and applied to the migration scenarios anonymously, resulting in a strong preference for one migration scenario (62% vs. 38%, see Table 4 for a selection of evaluation criteria). The same evaluation procedure was conducted with nine clinical care representatives from the three hospitals, leading to nearly identical results. Interestingly, criteria from the category HIS had the strongest influence on the results.

Finally, selected participants of the intensive workshop conducted SWOT analyses evaluating the scenarios in detail resulting in various assessments. Naturally, IT manager and IT provider rather supported the HIS already in place in their own institution, while external experts had a clear primary preference for the scenario that was already preferred in the criteria-based evaluation. The decision on the migration scenario made by the hospital management was based on the findings presented above.

4. Discussion

Because of tight time and cost constraints within the presented migration project, a customized process model was developed and presented in this paper. Three out of five phases had been successfully completed by the time the paper was written.

One of the main principles applied in the present model was the high degree of user integration. In phase 1, various stakeholders were interviewed and surveyed in order to identify key success factors, basic conditions and IT migration objectives. In phase 2, evaluations were conducted interviewing a large amount of process owners and system experts within the institutions. All findings were discussed intensively with

representatives from various professional groups in all three hospitals, which lead to a broad acceptance throughout all phases and finally the final decision on the migration scenario. This acceptance was necessary in order to avoid a perceived situation of winners and losers because of an imminent system change. The authors claim that this acceptance could not have been easily achieved without following a transparent and involving process model like presented. As Ahmad et al. [18] show, the appropriate involvement of various stakeholders is not only important in innovation processes but also in decision making processes and conclude that the involvement of stakeholders at an early stage can lead to decisions compatible with structural and cultural contexts. Involving stakeholders throughout the whole migration process is crucial for a sustainable success of migration projects. Not less than five key factors assigned to the category *human* are found among the top 10 most important key factors (Table 2). In comparison, only one key factor assigned to the category *system* can be found in the top 10. These findings also correspond to Bowns et al. [19], who relate most problems in the implementation of information management to human rather than technical factors. Therefore, it is crucial to address and involve stakeholders in IT migration projects in an early, decision making phase.

The extensive willingness of more than 40 stakeholders to participate in the project made it possible to create a good and productive working environment under the guidance of the research group implementing the present process model. Working together in such a heterogeneous group was not easily achieved because of more than 40 stakeholders from different professional groups, different hierarchic levels and different organization with even divergent interests from time to time.

Equally challenging like creating a productive and goal oriented atmosphere was the realization of the five days intensive workshop in phase 3 in order to develop and evaluate two IT migration scenarios. In addition to the migration strategy team representatives of the two HIS vendors were present and willing to work together in an unexpectedly constructive and respectful manner. It can be assumed that the setup of the intensive workshop was indispensable for successfully concluding phase 3 and for preparing a solid scenario decision for the hospital management accepted and supported by stakeholders.

One of the biggest problems was the fact that the new organization had not been legally founded at the time main decisions had to be made. The absence of decision-making competencies in single hospitals as well as no defined future IT provider led to temporary problems with the motivation among the staff and consequently to delays in milestone achievement. Further difficulties were caused by uncertainties concerning available financial and personnel resources. Having these conditions undetermined, technical decisions can only be based on assumptions and tend to be unnecessarily restrictive. Therefore, a competent project structure with transparent responsibilities and clearly defined budgets for various investments is highly recommended.

In addition, the establishment of a carefully designed and organized change management process is considered crucial in order to reduce the risks of frustration, resistance or refusal among employees. An established change management process accompanied by a proactive information policy can keep performance loss low [20].

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