BUSINESS INTELLIGENCE FOR YOU

BI4U

A scientific approach to Operational Management

A Case Study

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1   Introduction

Data warehouse systems collect records from one or more information systems. The source systems have their own way of writing the data to the medium. By using transformation methods, it is possible to extract the information from the source into a common collection of data. By using this collection, one can generate reports and analyses in order to make operational or strategic decisions. This is exactly the core business of BI4U (http://www.bi4u.nl). The companies director Niek Jetten asked me to write my Master Thesis at his company. I think it is a wonderful opportunity to get in touch with a commercial company. By writing with cooperation from a company, some kind of synergy is reached. The experiences I undergo while writing my Master Thesis are a big plus for my future career and writing at a company motivates in finishing the thesis. On the other hand, I was a bit skeptic about writing at a company. People warned me about the fact that a lot of students who wrote their master thesis at a company were seen as a cheap employer, fulfilling all kinds of jobs. After an interesting conversation with Niek Jetten and my speculator Marc van der Wielen it became clear to me that BI4U was aware of the needs for an academic thesis. Therefore, I want to thank BI4U for giving me this opportunity.

2   Problem statement

BI4U has developed a framework called the Intelligence Factory (based on the philosophy of KAIZEN (改善), derived from 'Continuous Improvement'). By using this framework, one is able to implement software products like ARIADNE in a generic way. ARIADNE is an information system, developed for the health care. The Business Data Model from ARIADNE includes information about the financial situation, staff, production and so on. The system generates, among other things, information about patient logistics. By writing this master thesis, I want to examine and improve the quality of the ARIADNE system, focused on the patient logistics part.

BI4U is, among other things, active in several medical centers. The information systems BI4U delivers are based on data mining techniques. The research question for this master thesis fits the need for a more effective way of recognizing processes. Data warehousing is a relatively new technique which is applied since the 90's. By sorting through large amounts of data and picking out relevant information, companies can

create analyses and reports which help in making the right strategic decisions. It would be very helpful for a hospital if their processes would be as effective as possible. I find it interesting to see if it is possible to recognize optimal/non-optimal processes by applying data mining techniques on the data, originating from patient logistics. Therefore, my research subject can be defined as follows.

> ***Research subject:***
>
> *A scientific approach to Operational Management. A case study with the purpose to be able to reason about an organization with regards to improve the business processes.*

Assume, there are a lot of records, pieces of information, belonging to a certain transaction, for example the medical removal of someone's meniscus. With this information, I am going to research if it is possible to use data mining techniques to determine if the process of removing the meniscus is efficient or not.

3   Product outcome

As a product of this master thesis, I will produce a document which describes the outcome of the research questions. This includes the conceptual model of the patient logistics' part of the ARIADNE information system, it's business model and the indicators needed to be able to reason about the quality of the system. Furthermore, I will investigate the possibilities of recognizing good and bad processes. Another outcome will be the derived business rules out of the patient logistics' part of ARIADNE. For example, when someone has received an invoice, this means he or she has undergone some kind of treatment and is mandatory known as a patient.

4   Theoretical framework

Like any other research, knowledge about the subject is needed. It is interesting to see if other research studies with similar subjects are available. If so, these studies can be used as a basis for my study. It is also necessary to create schemas and/or formal specifications of the patient logistics' part of the ARIADNE system. When these items are finished, they can be used to reason about the information system. Eventually, by using created indicators, it is possible to improve the quality of the information system. I will read various articles about the techniques behind data mining, etc. See the next chapter for a more detailed planning.

4.1 Area of knowledge

Research will be done in the discipline of Information Science. On one side, the subject has affinity with the technical aspects like data mining and so on. On the other side it touches the business side, since it is impossible to search for a generic way to recognize good and bad processes without having the knowledge about these processes.

4.2 Demarcation

During this research project, the scope will be limited to the level of patient logistics within a medical centre. With a view to the given time and resources, it is more feasible to concentrate on a concrete subject, other then focusing on the whole process.
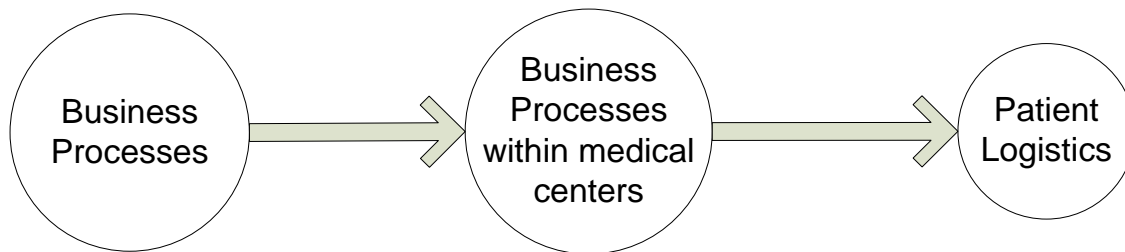
BI4U has developed a framework to implement Business Intelligence techniques in a generic way for customers in a wide range of industries, like health care, banking and power companies. By processing the patient logistics' part of the ARIADNE information system (creating a conceptual and a business model), eventually, it is possible to determine the quality of the processes which are responsible for the patient logistics.

5   Working method

5.1 Domain

As mentioned above, the domain will be representing the implementation of the ARIADNE information system within a medical centre, focusing on patient logistics. In order to answer this question, it is necessary to obtain information about how the Intelligence Factory is built and what the implementation of the ARIADNE information system look like.

5.2 Research Model

Using the approach of Verschuren, a research model for this master thesis was developed [Ver98]. During the creation of the action plan, it was necessary to draw the model several times, in order to get the research questions clear. The model can provide a broader insight regarding the relation of the research questions with the main goal of the research and provides a step-by-step approach of the research. See figure 4 for the research model.
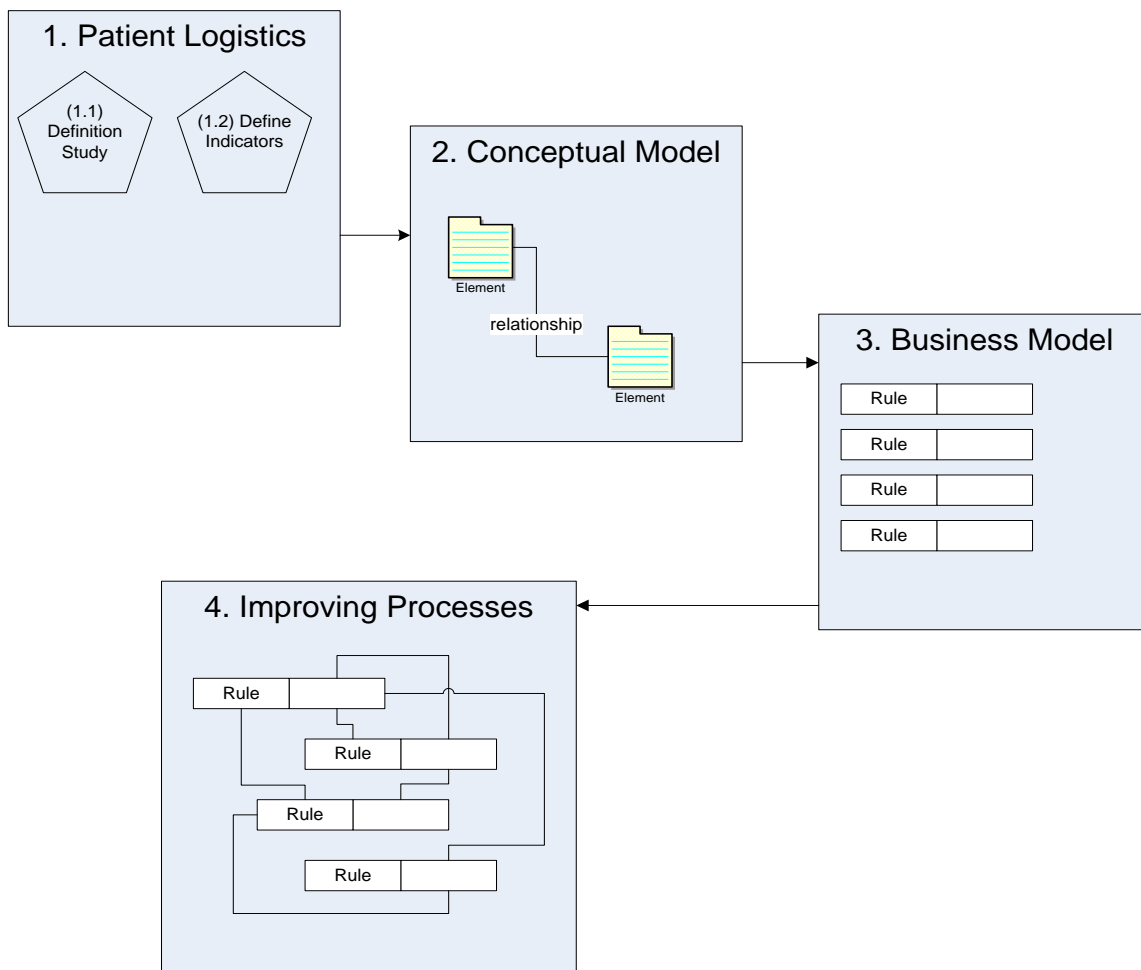
The phases can be described as follow:

1. What is patient logistics? In order to verify if a process is efficient and/or can be improved, one has to know what patient logistics exactly is. How can patient logistics be measured?
   - Make a definition of patient logistics
   - Define indicators which makes it possible to measure the quality of a hospital's patient logistics.

2. What does the patient logistics' conceptual model of ARIADNE look like? By examining the way a hospital works, one is able to write down the concepts, which include elements like patients and diagnosis, together with their relationships. An example of a relationship is the treatment a patient undergoes in order to heal the diagnosis.

3. After completing the conceptual schema, I will look at the properties for the patient logistics part of the ARIADNE domain. For example, a treatment can only be linked to some kind of object which is a patient. The union of the conceptual model, together with the properties of the domain (the rules) make the Business Model. When we make these rules part of the axiom, it is possible to derive all kinds of information. For example, someone has received an invoice, this means he or she has undergone some kind of treatment and is known as a patient. What kind of indicators can we introduce, in order to be able to reason about the quality of the business processes?

4. Next, I am going to use data mining techniques in order to improve the quality of the above discovered business processes.

5.3 Variables

To answer the research question, it is necessary to specify some indicators. Without these indicators, it would be impossible to determine if a process is good or bad. For example, to start measuring a process, we need some relevant information about that process. To get a clear view of the problem, a conceptual model of the patient logistics' part of the ARIADNE system will be developed, together with a translation to a Business Model. When these parts are done, it is possible to reason about the quality of the processes, with regards to patient logistics.

5.4 Relations between variables

The conceptual model of ARIADNE describes entities and relationships between these entities. During this master thesis, I will try to formalize this model and find a way to extract the business rules automatically. For example, we have an entity called patients. A patient undergoes some kind of treatment. This treatment is linked to a DBC, which is short (Dutch) for Diagnose Behandel Combinatie. We can now conclude that someone who has undergone a DBC is a patient.

6   Planning

6.1 Chapters

Writing a master thesis is an iterative process. Nevertheless, my intentions are to start with read up on the latest techniques about data mining. What sets of data is needed to successfully apply these techniques and so on. After this phase, I will investigate the possibilities in applying data mining in order to recognize good processes.

6.2 Timeline

September				October				November				December				January					February			
36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	01	02	03	04	05	06	07	08
Write PvA																								
				Conceptual model ARIADNE																				
								Translation Conceptual Model -> Business Model																
																				Improving Processes				
																						Finalizing		

7   Bibliography

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