

Role of Business Process Models in Requirements Engineering

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ABSTRACT

The goal of requirements engineering is to create a complete, consistent requirements specification of a desired system in order to establish the requirements at an abstract level.

Business process modeling in the early phases of requirement engineering is rather useful.

This paper examines business process modeling for the development of information systems. It presents the role of Business Process Model in Requirements Engineering. The process of Requirements Engineering is highlighted in this paper. It explains thoroughly the groundwork, requirements elicitation and business process model. Several Business Process Models are discussed at later part and how they are related to Requirements Engineering. It is enlightened the importance of Business Process Models in Requirements Engineering to get more precise and accurate requirements.

Keywords

Example:

Requirements Engineering, Requirements Elicitation, Business Process Model

1.0 INTRODUCTION

“Software Crisis” was the topic of everyone in 1969 (Naur, P., B. Randell, 1969). It can be defined as a non-familiar syndrome of problem. Researchers then put their efforts to know those non-familiar reasons of failure. Later in 1979 (Alford, M.W., Lawson, 1979), it was contributed in the study that indistinct requirements of the project leads it to the failure in cost, goal or performance.

Therefore, the concept of Requirement Engineering (RE) came into existence. The success of the Software System depends on the degree to which the system meets the requirements of solution of original problem defined. Requirement Engineering is the process of transforming real world idea into formal document that can be used as system specifications and further in Software Engineering Life cycle. This process includes identifying the real world problem, stake holders, their requirements and needs, documenting them in a form of

acquiescent to analysis, communication and translating into technical language so that they are ready to be implemented.

Broadly speaking, Software Engineering is the process of discovering that purpose that it was intended for, by identifying stakeholders, their needs, and documenting these in a form that is amenable to analysis, communication and subsequent implementation (Bashar, Steve, 2000).

Gathering requirements, analyzing them, making correction is a time and money consuming process. Whenever there is a failure in the system the first thing to be attacked is the correction of requirements. That can raise the cost of the software system up to the extent that there is no way of correction anymore. However, we can reduce this cost by processing the correct Requirement Engineering in correct manner with correct resources in correct time.

There is the trend in the air for combining Business Process Models with RE to maximize the assurance of correct requirements. As systems are growing in scale and complexity more accurate Requirements needs to be documented, therefore, Business Process Models are becoming more essential. Requirements cannot be separated from each other. Softwares are for business and if the requirements gathered are not align with business goals as described in business model, there is no use of that software.

The rate of failure in Software Systems in last decade is quite high. The reason for these failures is not technical; rather it is, misunderstanding the business model underlying or lack in support. Standing Group conducts surveys every 2-3 years (since 1994) to check the failure rate in software industry. According to these surveys (Standish, 2001, 2004), 18% were completely failed, 53% were challenged and only 29% of software projects were succeeded. This low rate of success primarily is the lack of clear and precise requirements. According to Standish group survey results, the failure in lack of clear and precise requirements is the poor conceptual modeling.

This paper enlightens the importance of Business Models in Requirement Elicitation. Section 2 explains the literature

review of requirement engineering. Section 3 explains business modeling. Section 4 proposes the ways forward available in the market. Section 5 concludes the discussion.

2.0 REQUIREMENTS ENGINEERING

The process of discovering, analysing, modelling and specifying business and user requirements for an information system is known as requirements engineering (RE) (Lemai Nguyen, Graeme Shanks, 2008).

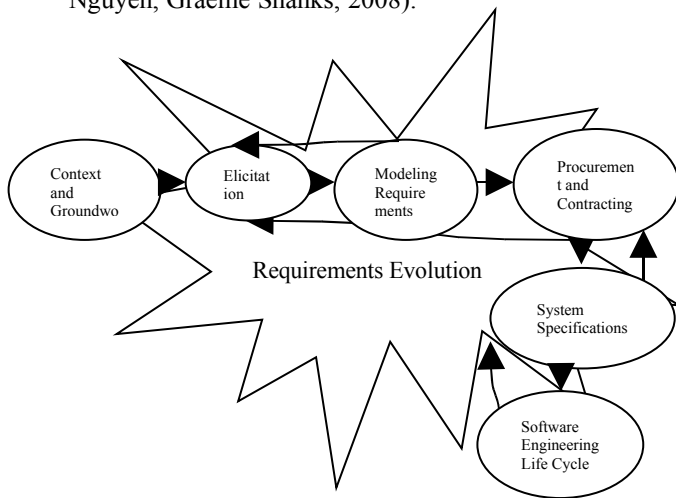


Figure 1: Requirements Evolution

2.1 Context and Groundwork

Finkelstein (1993) explained the importance of preparation before the actual project is started and he termed this process as Context and Groundwork. During the past decades Requirement Engineering term was interchangeably used with Requirement Specifications. Requirement Specifications were used to define for a specific customer who could sign off a Requirement Specifications (Bashar, Steve 2000). As the software world is changing rapidly it is not possible to use Requirement Engineering as Requirement Specifications.

Requirement Engineering is not only about the system specifications or requirement. It includes the whole lot process of defining problem statement or mission statement gathering, analyzing and verifying, validating, modeling, communicating, agreeing and evolving requirements. It makes up the ground for defining the system specifications and defining the model, processes and tools for the development of actual system.

Context and Groundwork is the study of feasibility and risks included in the development of the software system. It is possible to estimate the technical feasibility, project cost and schedule from a defined project specifications but it is also important to resolve the non-functional conflicts before time to avoid big cost later for error handling and re-constructing the

requirement over and over again during the software development life cycle.

Groundwork also includes the definition of requirement engineering process, models and tools/techniques.

2.2 Requirements Elicitation

Requirements Elicitation is often called as the first activity of RE Life Cycle. The most difficult and crucial part considered in RE is elicitation of requirement. Because RE concerns with non-technical, inexperienced and naïve persons who don't know what exactly are they require from the system. Requirement Engineer has to be a very critical thinker to understand, identify, capture, model and contract the desired requirements. Some people define the elicitation as gathering or capturing the requirements.

Requirement Elicitation is not only gathering or capturing the requirement but also analyzing, verifying, validating and agreeing on the gathered requirements.

The first step in Requirement Elicitation is Problem Definition or Objective Setting (Gerald, Ian 1998) i.e. to know what exactly the problem is to define the boundaries. These boundaries help in understanding the position of problem and its solution in existing running system. This existing system could be any software system or real-world. This step makes a ground to identify stakeholders, goals and tasks of the system.

The next step after defining the boundaries is to identify stakeholders. Stakeholders can be defined as anyone who is affected by success or failure of the developed system. Stakeholders can be individuals, organizations or even other software systems. Stakeholders includes customers (who pay for the system), developers (who design, construct and maintain the system), users (who interact with system to get their work done) (Bashar, Steve 2000) and other software systems (who are directly or indirectly related to the new developed system and that finally effect their customers, developers and users).

Goals are defined as the collection of the objectives of the system that it has to meet. Goals often conflict: they are allowed to, but requirements must not. So it's essential to discover and resolve any conflicts, as early as possible. Goals definition is always a crucial in the whole process. It is very difficult to define the clear cut goals of the system. However, researchers are working on Goal-Oriented Requirement Engineering (Hung, Axel & Philippe 2004, Axel 2000). Goal-Oriented Requirement Elicitation is an activity that continues as development proceeds, as high-level goals (such as business goals) are refined into lower-level goals (such as technical goals that are eventually operationalised in a system).

Requirement Engineer can also resort this problem by extracting information from the user day to day tasks, their problems in handling those tasks and areas of improvement. These tasks can often be represented in use cases that can be used to describe the outwardly visible requirements of systems and these uses cases can be used in different scenarios to better understand the requirements and usage of system.

The choice of elicitation technique depends on the time, resources and previous knowledge available. Here the term previous knowledge includes three types of knowledge:

1. Known constructs
2. Partially- known constructs
3. Unknown constructs

In known constructs the problems are clearly known. The data about the problem is available and Requirement Engineer exactly knows what the boundaries of the system are. In partially-known constructs also problem statement is defined but it ambiguous. Every stakeholder has different goals and requirements which conflict with the other stakeholder's benefits. In this type of situation Requirement Engineer has to be very careful to define a concise, correct and implementable problem statement so that it is in the maximum benefit of every stakeholder of the system. In unknown constructs situation it is very easy and also very hard for Requirement Engineer to state a problem. In this kind of situation everyone wants something without knowing their requirements. In this span sometimes it is very easy to satisfy stakeholders and sometimes it is very hard to satisfy stakeholder. In this type of circumstances Requirement Engineer has to tackle the stakeholder not only technically but mentally also.

3.0 BUSINESS PROCESS MODEL

Running a business today under highly competitive economical conditions is not easy. Technology-induced market globalization, the demand for high-quality products that are manufactured at lower costs and developed faster, changing customer requirements as well as other internal and external factors persuade companies to adopt new rules. Companies that do not change their manufacturing, management or service strategies will find it difficult to succeed under such challenging circumstances.

In recent years there has been a growing emphasis in RE research on the use of appropriate and rigorous research methods and techniques. Many of the developments that have been seen have been related to the areas of quantitative and statistical approaches in empirical RE. For those undertaking qualitative studies there often seems to be a lack of obvious

approaches that can be used to support meticulous work in the area.

Several authors have pointed out the importance of organizational modeling before requirements elicitation (Kavakli, E., Loucopoulos, P. 2004, Regev, G., Wegmann, A. 2004, Yu, E. 1995). Software analysts must take the business environment into account so that the system properly fulfils the needs of the organization while developing a system. Even though RE is the association between organization and system domains, most of the research in this area is still solution-oriented, which does not address the real problems of the organization. As a result, since the organization is not correctly analyzed, the software system may not meet expectations, and business/IT alignment will not be achieved. To avoid these problems, it is necessary to merge a business processes and RE to allow software requirements to support the operations of an enterprise and assure business/IT alignment.

Business process Modeling is becoming an essential part of any software development process. Software systems are designed to help business activities and finally achieve business goals. Understanding business model and taking into concern while eliciting requirements makes requirements more real, helps to understand the exact problem and easy way out. It allows the analyst to draw the boundary and procedures that direct what it is a business does. Business Process Model provides an overview of where the proposed software system being considered will fit into the organizational structure and daily activities. It may also provide the justification for building the system by capturing the current manual and automated procedures that will be rolled up into a new system, and the associated cost benefit (Geoffrey Sparks, 2000).

It allows the analyst to capture the major measures, inputs, resources and outputs related with business process. By connecting later design elements (such as Use Cases) back to the business process model through implementation links, it is possible to build up a fully traceable model from the broad process outlines to the functional requirements and eventually to the software artifacts actually being constructed.

Business Process Model usually has a broader and more comprehensive range than just the software system being considered, it also allows the analyst to clearly map what is in the span of the proposed system and what will be implemented in other ways (eg. a manual process).

Business strategy/model is defined by organizational managers. It is a difficult task due to the complexity of business management. As a consequence, several models, such as BSC (Kaplan, R., Norton, D 1996), ISO 9000 (International Organization for Standardization), or EFQM (European Foundation for Quality Management) have been formulated to

support proper business strategy definition and organizational management.

These models explain business strategy by means of an organizational mission statement and the strategic goals that support it. The mission statement states why the organization exists and its main objective, whereas strategic goals represent how the mission can be fulfilled and why processes exist. In order to assess the success of the enterprise, measures related to strategic goals and their target levels are defined.

Goals have been widely and successfully used in RE (Kavakli, E., Loucopoulos, P. 2004, Lamsweerde 2001).

A goal can be defined as a state that must be reached, and its definition makes reference to a set of properties whose fulfillment must be guaranteed.

In the context of the business structure, business modeling attempts to answer the following questions: how do the business actors interact; what activities are part of their work; what are the ultimate goals of their work; what other individuals, systems or resources are involved that do not show up as actors in this specific system; what rules govern their activities and structures; are there ways in which the actors could perform more efficiently.

Ideally, a business model should consist of one diagram that takes into account various important aspects of the business. In reality, this is impossible because a business is a rather complicated mechanism and a single diagram is not capable of holding all the necessary information. Business modeling, thus, involves a set of related diagrams. The types of diagrams and notations used depend on the chosen method/technique of modeling.

One technique was introduced named as enterprise modeling. Enterprise modeling is the process of understanding an enterprise business and improving its performance through creation of enterprise models. This contains the modeling of the relevant business domain (usually relatively stable), business processes (usually more volatile), and IT. Enterprise modeling is currently in use either as a technique to represent and understand the structure and behavior of the enterprise, or as a technique to analyze business processes, and in many cases as support technique for business process reengineering. The need for enterprise modeling stems from a number of different considerations but there is a common thread amongst all these approaches namely “the need for integration and co-ordination of activities required in order meeting rapid change” (Loucopoulos, P., Kavakli, E., 1995).

Enterprise model is a computational representation of the structure, activities, processes, information, resources, people,

behavior, goals, and constraints of a business, government, or other enterprise. “It can be both descriptive and definitional spanning what is and what should be”. The role of an enterprise model is to achieve model-driven enterprise design, analysis, and operation.

RE is not only a process of discovering and specifying requirements, it is also a process of facilitating effective communication of these requirements among different stakeholders. The way in which requirements are documented plays an important role in ensuring that they can be read, analyzed, re-written, and validated according to the enterprise goals.

Business modeling and business process modeling, nevertheless, differ in many ways and to avoid confusion, the main features of business modeling as well as of business process modeling are explained in following paragraph.

An understanding of the construction and functioning of a business process is a necessary precondition for many projects. For this reason, various approaches, modeling techniques and tools address the problem of the modeling of business processes. All these methods and tools have something in common: they attempt to solve a critical problem. People with very different backgrounds, such as business managers, workflow specialists, software consultants, designers and software developers, participate in the development of software solutions that support business processes.

It is necessary for all the parties involved to understand the essence of the business process model through communication that spans the entire lifecycle of the project. Possessing a common language, understanding the structure and behavior of a business process, formulating the requirements in an unambiguous manner, mapping the business requirements to the software components, interpreting the business rules correctly and presenting the software solution to the users of the future system are all very important factors which determine the success or failure of a project.

There are certain issues with existing business process models and are not currently in use to a large extent. In the case of structured software development, problems ensue from the use of different techniques at each stage, which means that the results of each step of the development process must be converted in order to be usable in the next step. Hence, procedural programs do not have very much in common with, for example, DFD that is the essence of structured analysis

In structured analysis, it is possible to concentrate on the modeling of data or action only. On the other hand, separating data from action is not reasonable, since data cannot be altered without being the object of action and actions are completely meaningless without associated data. Object-oriented analysis

takes into consideration both data and action; in this way, an object consists of data as well as of actions that are performed on the data. But there is a lack of process views and that top-down decomposition is barely supported in object-oriented techniques. Although Marshall has demonstrated that if a business process is too complicated and bulky to present in one diagram, it can be decomposed it into a number of sub-processes. However, OOP lacks in providing good view of business process rather they give more panoramas to system's technical part.

4.0 WAY FORWARD

Several suggestions consider business modeling as the first step for software development. Some of them are i* (Yu, E 1995), KAOS (Stevens, R., Brook, P., Jackson, K. & Arnold, S. 1998) and EKD (Bubenko, J., Persson, A., Stirna, J 2001). Approaches that use UML are Eriksson (Eriksson, H., Penker, M 2000) and Marshall (Marshall, C. 2001).

The i* model is focused on the dependencies between the organizational actors. Its models are considered to be strategic because actors are not only interested in achieving their own goals, but are also interested in relationships with other actors. But i* models are too complex and are not scalable when applied to large real problems.

KAOS requirements models are built from organizational goals. This approach is supported by a formal structure that thoroughly defines each term. Its main contribution is that it reveals that requirements correspond to system goals. However, one disadvantage is that it does not provide any method to describe business processes.

EKD presents a way of analyzing an enterprise by using enterprise modeling. It is made up of a goal model, a concepts model, a business rule model, a business process model, an actor and resources model, and a technical components and requirements model. EKD may be not convenient to use because its models are standardized. The tools are not available.

The UML based approaches are standardized but they use elements that are very close to those essentials used in the software development area. These approaches do not clearly state some organizational aspects such as technology that implements business processes or the relationships among the different organizational views.

Business models can, nevertheless, be totally accurate and complete, for which there are several reasons: (1) the changes in a company's environment might alter the basis on which the model was created; (2) very detailed models might become as complex as the business itself and, thereby, hard to understand; (3) stakeholders might resist overly complex models due to

their intricacy; (4) not every detail can be fixed during the modeling process because each method/technique has its evident restrictions, etc.

Nevertheless, in spite of the contradictions, business modeling remains a rather popular method in RE. Even with these limitations, the following arguments are still strongly in favor of producing business models: (1) to better understand the key mechanism of an existing business by providing a clear view of the roles and tasks in the overall organization, the business model can; (2) to act as the basis for improving the current business structure and operation. The business model identifies current business changes that must be implemented in the improved business model. In literature, researches refer to this technique as business process re-engineering.

Modeling of a complex business requires the use of multiple views that focus on particular aspects of the business and are described using a number of diagrams, sometimes complemented with textual documents.

1. The business vision: an overall vision of the business. It describes the goal structure for the company and illustrates problems that must be solved in order to reach these goals.
2. The business process: the view that represents the activities and value created in the business and illustrates the interaction between processes and resources.
3. The business structure: the way the resources in the business are structured, such as the organization of the business or the structure of the products created
4. The business behavior: the individual behavior of each key resource and process in the business model.

These four views constitute the business model, although the business process view is the core of the whole model. The business process view describes the process in the business along with goals, resources, and activities of the processes.

Business process modeling is, thus, the most important part of business modeling in the RE context and is chosen by some authors as a RE technique for information system development.

The main goal of business modeling is to reach an agreement among stakeholders regarding the question of who is offering what and to whom. On the other hand, business process modeling is oriented towards understanding how activities should be carried out. Business modeling provides an idea of the overall operation of the business; business process modeling emphasizes the workflow of actions and information.

The business process model exhibits the following design decisions:

1. Who the actors involved in the company operations are
2. Which activities can be distinguished; which activities are executed by which actors
3. What the inputs and outputs of activities are; what the sequence of activities is
4. Which activities can be carried out in parallel?

There are, thus, several questions that the business process model can help solve.

The main purpose of building a model is to obtain the following results:

1. a definition of a process; to establish a communication link with other processes
2. To share the process across a group of people
3. To negotiate around the process. In the software requirements phase, this type of modeling can help in the very beginning when the current process model is presented to the stakeholders for their approval. It shows how accurately the developers conceive the business itself. This type of modeling allows for no mistakes in the way that business activities are understood when constructing the basis for RE.
4. Once a model has been built, it may be necessary to improve the quality of the model by exploring the properties of the processes themselves in order to provide support for the desired information system at the highest level.
5. Certain analytical questions can be raised at this point; for example, what is the process life cycle and what are its bottlenecks; why is the documentation turnover so long.

These questions may improve the model by changing the way:
 (1) In which company activities are organized; altering the responsibilities for active decisions; (2) restructuring functions in order to align them better with the business processes (3) increasing and decreasing the number of parallel activities, etc. (4) modeling for analysis is very helpful when there is a so-called backbone model for describing processes.

5.0 SUMMARY

Requirement Engineering is a difficult task to be done accurately. Organizational model and process must be taken into account to make sure alignment of proposed solution with the goal of organization.

This paper examined issues concerning business process modeling in requirements engineering. Business process modeling was considered as being a part of business modeling.

It has illustrated relevance to derive requirements models from organizational models by ways of processes goals. Merging of business models into requirement engineering allows developers to identify the system requirements that will support the organization in a methodical and participative way, where business managers, business analysts, and system analysts all take part. Since requirements are defined from business processes that support strategic goals, this approach guarantees business/IT alignment.

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