Qualitative Requirements Analysis Process in Organization Goal-Oriented Requirements Engineering (OGORE) for E-Commerce Development

Fransiskus Adikara(✉), Sandfreni, Ari Anggarani, and Ernawati

Esa Unggul University, Jl. Terusan Arjuna, Jakarta, Indonesia
fransiskus.adikara@esaunggul.ac.id

Abstract. One of the most important processes in requirements engineering is the requirements analysis process. This paper propose the qualitative requirements analysis process to improving e-commerce system quality using OGORE. The proposed method will completing the previous research with adding qualitative analysis in the process based on AGORA method. By completing the requirements analysis process in OGORE with qualitative analysis, the proposed method can eventually become a new addition to the pre-existing requirements analysis process and can also be used especially in e-commerce system development process. With this qualitative requirements analysis, the Non Functional Requirements (NFRs) of e-commerce system can also be analysis using OGORE.

Keywords: Requirements engineering · Qualitative requirements analysis · E-commerce · Non-functional requirements

1 Introduction

Nowadays in the midst of information and communication technology advantages, internet usage has become an important part in business and trading activities. Almost all aspects of human life impacted by the internet and the business sector is the most perceived by it. E-commerce growth in developing country has significantly increase year by year.

The process of developing information systems including the development of e-commerce system in Indonesia, and other developing countries still face many problems [1]. The most frequent problem occurs when Requirements Engineering (RE) process is not met during information systems development process. Improper and incomplete requirements engineering greatly affects the success rate of information system development. From a previous study it has been concluded that the problems occurring in engineering needs are one of the main causes of an information systems project experiencing budget overruns, delays, and reductions in the scope of work that diminish the ability and effectiveness of the software produced for the company [2, 3].

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GORE approach is expected to minimized the increasing requirements that originally come from user interests [4, 5]. In our previous paper [6], we proposes an extension of GORE approach that uses the organization goals (the overall objectives, purpose and general mission of an organization) to elicit system requirements, so the system functions and the resulting requirements can be more qualified and relevant with organizations missions rather than user's interests. In other paper, we also proposes the use of Case-Based Reasoning (CBR) method in requirements engineering process and combine it with AGORA method to refine and analyze requirements [7]. The combination is intended to get the high quality requirements that are based on the reuse of requirements from literatures, best practices, and previous experiences that are recorded in a Case-Based.

Based on the backgrounds described above and continuing previous research on organization goal-oriented requirements engineering (OGORE) [1], this paper propose an requirements analysis process to improving the quality of e-commerce system. This analysis method propose to be applicable in e-commerce systems engineering process. The propose method can eventually become a new addition to the pre-existing requirements analysis methods and become a new method that prioritizes in e-commerce system development process.

This paper is organized as follows. In Sect. 2, the paper starts with the overview about some related works. In the next section, we explain the requirements analysis process in our proposed approach. We discuss the detailed process of our proposed requirements analysis in Sect. 4, and finally the conclusion in Sect. 5.

2 Related Work

The term e-commerce began to emerge in the 1990s through an initiative to convert the paradigm of sale and purchases transactions, and payments from conventional ways into electronic digital forms based on computers and Internet networks [8]. This is very contrary to the conditions before the e-commerce in the world. At that time transactions are made directly through face to face between the provider of goods and services with consumers, even long before the money is created, the transaction is done through a barter process, namely the exchange of goods. The common features of e-commerce functionalities and architecture [9] are consist of two major part: Store Front and Back Office. For Store Front, the e-commerce system should have these function: Registration, Product Catalog, Product Ordering, Payment, and Customer Service. The Back Office of the e-commerce system should handle the ordering and manage to deliver the product to customer, so the system should have these function: Ordering Management, Product Management, Warehouse Management, Payment Management, Customer Relationship Management, and Content Management System.

In previous research [7], based on Case-Based Reasoning (CBR) method theory [10], the proposed requirements engineering process approach is illustrated in Fig. 1. In the previous research about the requirements elicitation process needs [4], we have discussed how to describe the Initial Goal Tree Model, KPIs (*Key Performance Indicators*) and business domains used as initial information for requirements refinement and analysis process.

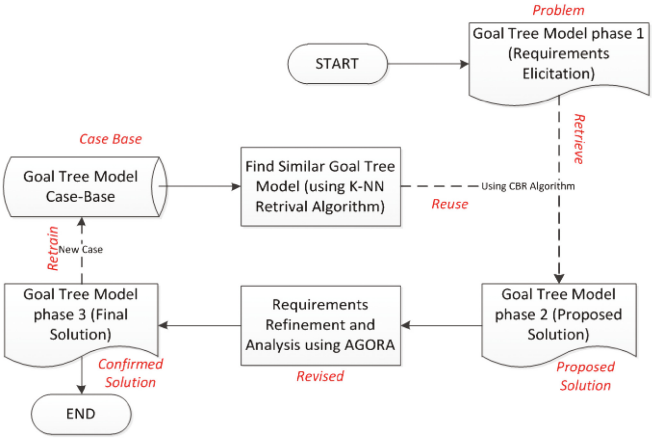

Fig. 1. Flowchart of CBR method approach in organization goal-oriented requirements engineering (OGORE) process [7].

In general, this approach have four steps [7], as the followings:

- *Retrieve*: The objective is to recognize the new cases (problems) using the result of requirements elicitation process. Thus, the case attributes in the propose method consists of: business domain, goal, and KPIs.
- *Reuse*: In this activity, the system uses existing solutions in case-based to address new problems. These existing solutions have some degree of similarities to the new problems. The case-based consists of goal-tree model that is built from best practices, previous solved solutions and literature studies.
- *Revise*: The proposed solutions that were obtained from case-based is re-evaluated to address the new problems. The requirements analysis process is then performed to get the best solution goal tree models for the organization. The analysis process used modified AGORA method to resolve conflicts in the requirements. At this stage, solution goal tree model is produced.
- *Retain*: In this final stage, the refined problem solutions in the form of goal-tree model are kept in the case-based. These solutions are to be used in the future.

To assess the KPIs achievement within a goal, the analysis method modified AGORA [7] as Requirements Analysis Process. In this paper, this process will be add with qualitative requirements analysis to complete the previous method.

Non-functional requirements (NFRs) are commonly characterized from functional requirements by differentiating how the system shall do something in contrast to what the system shall do. A NFR is an attribute of or a constraint on a system, NFRs or named quality attributes, e.g., how to make Web content accessible to people with disabilities [11]. Quality goals (sometimes called "non-functional goals") refer to non-functional concerns such as security, safety, accuracy, usability, performance, cost, or interoperability, in terms of application-specific concepts [12].

3 Research Methodology

In the early stages of the research will develop a requirements analysis method of goal-oriented requirements engineering for e-commerce system. This research is a continuation of previous research that once discussed. With this research, the focus is more on the development of e-commerce system. This process will be more beneficial to the development of e-commerce system.

The first phase of this research is designing requirements analysis process by taking these preparatory steps: literature study and doing analysis of existing requirements analysis techniques. This designing activity is undertaken in conjunction with stakeholders and requirements engineering experts.

The results of first phase will be used in the next phase to modifying the requirements analysis method specially for e-commerce system engineering process. Once developed, the requirements analysis methods can be implemented in the development of e-commerce system.

4 Requirements Analysis Process for E-Commerce System

Continuing previous research using CBR to conduct refinement and analysis process, then in this research focus on requirement analysis process by doing modified activity especially to get non functional requirement. Non-functional requirements (NFRs) are commonly distinguished from functional requirements by differentiating how the system shall do something in contrast to what the system shall do [12]. NFRs are usually documented separately from functional requirements, without quantitative measures, and with relatively vague descriptions. NFRs difficult to analyze and test. In e-Commerce there NFRs are things that related to network infrastructure, the minimum hardware requirements, legality, and regulation for e-Commerce.

The complete requirements analysis process for e-commerce based on the modification of AGORA [13] method that we propose in this paper have two types of analysis: Quantitative Analysis and Qualitative Analysis. Not only quantitative analysis that already proposed in previous research [7], in this paper we propose Qualitative Requirement Analysis on the OGORE method to be used to gauge the level of rationality defined on each task that wants to fulfill its purpose. With this rationality measurements, we can know which one of the requirements that can be met with or without regard to the functionality of the system.

How to conduct an assessment for this qualitative analysis by writing down **the rationale statement** connected to an attribute or being on a node or edge that illustrates the reason why the analyst describes the goal to be a sub-goal, and/or answers the question of why a sub-goal is assigned a particular attribute. No measurement is bound to determine whether a rationalization is acceptable or not. Stakeholders can sit together to discuss and determine which non-functional needs are to be used or not based on beliefs owned by the organization.

In addition of Qualitative Analysis process we also propose the refinement of quantitative analysis process in previous research. Quantitative Requirement Analysis on the

proposed method is used to assess the level of preference of high-level stakeholders against defined goals so as to analyze possible conflicts among stakeholders regarding the point of view of the goal. Our quantitative analysis is measure the ability of the task to fulfill the goal. Measuring tool used is as follows:

1. **Preference Matrix (PM):** connected to the node of the KPI and the goal, indicating the level of preference of each stakeholder against the goals and KPIs established so as to indicate the level of satisfaction of the stakeholders against the goal and established the KPI.
2. **Contribution Value:** connected to the edge and represents the contribution rate of the goal/task in achieving the goal and the KPI from the parent goal.

The Preferences Matrix assessment begins in the following way:

1. Each pre-defined goal will be assigned a preference value by each stakeholder. The first stakeholder gives an assessment of the Preferences Matrix of its preference level or satisfaction to the existing goals and KPIs, the value is given using a scale from −10 to 10. The lowest value is given, if the stakeholder is less satisfied and the highest value, if it feels very satisfied with the goal and KPI - his.
2. In addition to assessing itself, each stakeholder must also provide a satisfied value (self estimate) of each other stakeholder, for example to stakeholder O, must give the value of satisfied stakeholders to the second and also the third stakeholder of the goal and KPI is based on subjective assessment of the first stakeholders. And then the second stakeholder and also the third stakeholder to fill the overall matrix of preference in each goal do the same thing.

After that the stakeholders who act as the necessary engineers will give contribution value from each end/edge in achieving goal and KPI from the parent. Scale value from −10 to 10. The lowest value means to contribute negatively or not contribute to the goal whereas the highest score means that the edge has a good contribution to the achievement of the goal. The following Table 1 show the example of Preference Matrix of a goal, O refer as Owner of the Organization, BA as Business Analyst, and SA as System Analyst.

Table 1. Example of preference matrix.

	O	BA	SA
O	5	−6	4
BA	−5	3	1
SA	0	2	10

The analysis of the Preferences Matrix is done by looking at the variance value of the first stakeholder column compared to the variance of the second stakeholder column. If there is a big difference in the value of variance then it shows that the first stakeholder has a different view with the second stakeholder on the determined goal and KPI. Based on this data, the analyst of the needs engineer can find out which parts are still not understood by the first stakeholder or the second stakeholder. This difference in point of view can be a constraint that inhibits the establishment of system requirements. Therefore it must be resolved by discussing the stakeholders with the necessary

engineers, so that in the end the Preferences Matrix already does not have a very wide variation in value variance.

For an analysis of the value of contribution made by looking at the value assigned to a field goal. If the value of the contribution is still negative, then the goal becomes a constraint and needs to be considered to remain a system requirement or not. The solution of Goal Tree Model can be set if there is no more negative contribution value in the overall goal that exists. The example of Quantitative and Qualitative Requirements Analysis in Goal-Tree Model is illustrated in Fig. 2.

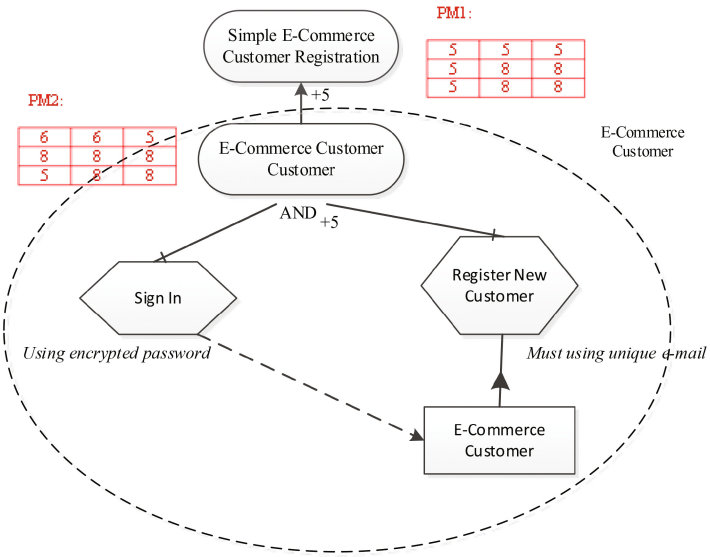

Fig. 2. Example of quantitative and qualitative requirements analysis in goal-tree model.

If there still a negative value on the contribution value and the variance of preference matrix value still very high, then high-level stakeholders should sit in discussions and negotiations on the tasks or goals derived so that the agreement is found in the achievement of the master goal based on the rationale written. When the analysis results show that there is no negative value of Contribution Value that shows the inability of the task or goal to the achievement of the parent goal, the final result of the analysis of Proposed Goal Tree Model is called Solution Goal Tree Model [7].

5 Conclusion and Future Work

To conclude, by the improvement of requirement analysis process in this research, hence requirement analysis processes not only do quantitative analysis, but can also do qualitative analysis. Development of e-commerce system in addition to dealing with the functional needs of the process of sale and purchase transactions and payments, the system also depends on the ability of network infrastructure/internet, hardware

capabilities, legality, and security. The qualitative analysis process does not have a standard rule of whether an NFR is acceptable or not, but depends more on the rationality of the process and determined by the stakeholders who determine it. With this proposed analysis process, the CBR process of OGORE to get high quality requirements can be more complete especially in Revised Process, not only doing quantitative requirements analysis, but also can perform qualitative requirements analysis process.

By the process proposed, further research could use the proposal of this method to be implemented in a process of developing an e-commerce system. From the results of the implementation can be assessed the quality of the process and get the results of the needs of e-commerce system.

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