Reflective Report

Nikhil Yarlagadda
9405251993
niya15@student.bth.se

1. Article Selection:

The articles that I have selected for implementing in this assignment are

Article 1: **"**Requirements Abstraction Model**"**

The main reason for selecting this article[1], is because a clear explanation of RAM model is
presented by the authors, when it is used, why is it used and need for the RAM model. A guide
how to implement and connect the requirements to abstract levels is provided which makes the
process easier for breaking the requirements into abstract levels. RAM model contains several
steps, each and every step is clearly explained and illustrated with the help of an example. Along
with this, the process involved in RAM model is very interesting. After looking into this article, I
thought this model would be simple and ease to implement by following the information and guide
provided in the article.

[1]   T. Gorschek and C. Wohlin, "Requirements Abstraction Model," *Requir. Eng.*, vol. 11, no.
       1, pp. 79–101, 2006.

Article 2: **"**A Cost–Value Approach for Prioritizing Requirements**"**

The reason for selecting this article[2] is because the proposed approach "Cost-value" is clearly
explained with an example. The description provided in this article is good enough to provide an
idea about the implementation of this method practically. Another reason for selecting this article
is to know how this method prioritizes the requirements from a large number of requirements.

[2]   J. Karlsson and K. Ryan, "A Cost-Value-Approach for Prioritizing Requirements," *IEEE
       Softw.*, vol. 14, no. 5, pp. 67 – 74, 1997.

Model Description:

Article 1: RAM Model

The main aim of the RAM is to provide a requirement engineering model that helps professionals
with product planning and development. It supports the continuous requirements engineering
effort, aimed at taking the requirements at multiple levels as input and offers a structure for

breaking down these requirements into detailed ones and vice versa by means of work-up. RAM model is implemented in three steps in requirements engineering

- **Specify**: It involves specifying the initial requirement and eliciting enough information about it to specify a number of requirements. Four attributes are manually specified they are
    - o Description: It provides the central essence of the requirement.
    - o Reason/Benefit/Rationale: It deals with why the requirement is specified and benefit of the requirement.
    - o Risk/Restrictions: This attribute describes the restrictions and risks with the requirements.
    - o Title: It reflects the contents of the requirement.
- **Place**: It is centered around what abstraction level the now specified requirements reside on. It consists of four abstraction levels they are
    - o Product level: It is the most abstract level. In this requirements are considered abstract enough to be comparable directly to the product strategies.
    - o Feature level: It is next level in the model. The requirements on this level are features that the product supports.
    - o Functional level: This requirement should be a descriptive of what a user should be able to perform. It mainly concentrates on the functional activities.
    - o Component level: It is the last level in the model. These requirements are of a detailed nature depicting information in detail. These act as a possibility to breakdown functional level requirements into more detail and set the limits to functional level requirement.
- **Abstraction**: It involves breakdown of requirement, depending on initial placement of original requirement. The work- process involves the creation of new requirements to the adjacent levels or linking the existing requirements. Two rules are used to do this work-process they are
    - o Rule 1: NO requirement may exist without having a connection to the product level
    - o Rule 2: All requirements have to be broken down to functional level.
- If the requirements are not specified in the other levels, then the additional requirements are specified in the abstraction levels until workup rule R1 and R2 satisfied. A how-to guide is also provided to help how to specify the requirements in the abstract level.

Article 2: Cost-Value Approach

The cost-value approach is a process for prioritizing the software requirements. In the cost-value approach, the candidate requirements are ranked by considering two dimensions they are

- According to their value to customer and users
- According to their estimated cost of implementation.

There are five steps for prioritizing the requirements using cost-value approach. They are

- Candidate requirements should be carefully reviewed by requirement engineers to ensure that the requirements are unambiguous.
- Customers and users apply the AHP's pairwise comparison to achieve the relative value of the candidate requirement.
- AHP's pairwise comparison should be used by experienced software developers for finding the relative cost for implementing the candidate's requirement.
- A software engineer uses AHP to calculate each candidate's requirement's relative value and implementation cost, and plot theses on a cost-value diagram.
- This diagram will act as a conceptual map for analyzing and discussing the candidate requirement by the stakeholders.

The software managers prioritize the requirements and decide which will be implemented and also used for developing the strategies for release planning.

2. Implementation Plan:

The implementation plan to be carried out for the article 1 is, I have taken requirements from the course management system. The article provides a how-to-guide aids, which helps in placing the requirements at the different levels and also for abstraction and breaking down of requirements. A total of 16 requirements are considered for implementing this method because it is not possible to implement it on thousands of requirements as it is difficult to deal with such a large number of requirements individually. As this assignment is mainly intended to know about the implementation of the method, the knowledge (process implementation) gained through implementing selected 16 requirements and the knowledge (process implementation) gained through the implementation of thousands of requirements would be similar. For storing all the requirements, I have used excel sheets.

For article 2, I have selected requirements from the course management system. As this article clearly provides the steps required for the implementation of cost value analysis approach. A total of 10 requirements are considered for implementing this method by following the steps provided by the article. Only 10 requirements are considered for implementing this method because it mainly deals with calculations. Pairwise comparisons will be done between requirements and it will be become complex when the number of requirements are increasing more over the process remains same for any number of requirements. Along with this one more reason for limiting the requirements to 10 is because of the time to implement. For storing the requirements and

performing mathematical calculations excel sheets are used to make the calculations process little bit easier.

3. Execution:

Article 1: "RAM Model"

For this model, I have selected requirements from the course management system from my assignment release planning. The execution process for this model is carried out in three steps as follows:

- Specify:

In this step, the requirement is elicited and a clear information about the requirement is obtained from this step by using the four attributes. If the attributes are not available they are provided with NA.

- Place:

In this step, the requirements obtained from the specify level are placed among one of the four abstract levels by using a how-to-guide aids provided in the article. A how-to-guide provides guidelines for selecting the abstract level and placing it. For example, a requirement "A Course shall have a file archive" is considered. Based on the provided guide lines it should be placed in one abstract level among four i.e. feature level.

- Workup:

This is the final step in the RAM process, in this step the requirements placed in one abstract level are worked up. The work- process involves the creation of new requirements to the adjacent levels or linking the existing requirements. At the end of this step, the requirement should contain in all the abstract levels. For example, a requirement "A Course shall have a file archive" is placed in the feature level. It should contain requirements in the remaining three abstract levels i.e. product, function and component level.

These three steps are carried out for every requirement. A total of 16 requirements are taken for this model and information for each requirement is provided clearly and placed in the suitable level. After this work up process is carried out for all the 16 requirements and new requirements are created and placed in the adjacent abstract levels and a total of 64 requirements are obtained finally. All the requirements in each step are stored in a separate excel files which clearly provide the process carried out and each step.

Article 2: "Cost-Value Approach"

For this model, I have selected requirements from the same course management system i.e. from my release planning assignment. The execution process is carried out for this approach is in five steps

- Step 1:

  In the first step, all the candidate requirements are clearly reviewed. In order to find whether the requirements are unambiguous are not. If there are ambiguous requirements, then they are not considered in the approach.

- Step 2: Relative value

  In this step, AHP's pairwise comparison is done between all the candidate requirements in order to achieve the relative value of the candidate requirement. The values taken are based on the customers and user's context.

- Step 3: Relative cost

  In this step, AHP's pairwise comparison is done between all the candidate requirements in order to achieve the relative value of the candidate requirement. The values are given based on developer's context.

- Step 4: Cost value diagram

  The results obtained from the step 2 and step 3 are used for calculating each candidate's requirement's relative value and implementation cost, and plot these on a cost-value diagram.

- Step 5: Analyzing the cost-value diagram

  This diagram will act as a conceptual map for analyzing and discussing the candidate requirement by the stakeholders. This graph is divide into three distinct areas (low, medium, high) and the requirements with in this area considered as low priority, high and medium priority requirements.

A total of 10 requirements are considered and executed. All the data and mathematical calculations are stored and done using excel sheets to reduce the burden to some extent.

4. Proof Concept:

Article 1: "RAM Model"

I have applied this model, on a total of 16 requirements selected from the course management system. One of the example from the 16 examples is explained here.

"A Course shall have a file archive"

The first step of this model is specify in which the requirements are elicited and considered with clear information. All the attributes title, restrictions and why are also available for this requirement which gives a clear information about the requirement. The process carried out in this step is stored in the excel sheet and is provided in the link below

https://drive.google.com/open?id=0Bywub6ieBaBbekw0ZzM1d0ExQVk

The second step of this model is placing the requirement among the suitable abstract levels. Among all the four abstract levels and based on the guidelines provided in the article this requirement is paced in the feature level. Before placing it in the feature level I once checked all the possible levels. The process carried out in this step is provided in the excel sheet for the other remaining requirements.

"A Course shall have a file archive" -Feature Level

https://drive.google.com/open?id=0Bywub6ieBaBbSUlKcW43dTVVNEk

The last step of this model is to break and abstract the requirements into the remaining abstract levels. The requirement considered is placed in the feature level. The remaining three levels for this requirement is created and linked with each other and this process is carried out by using the guidelines provided in the article.

Product Level – "The system should support and provide storage"

Function Level- "Participators in a course shall be able to browse the file archive and download files from the course file archive. The course administrator has the privileges to add/remove and edit the files in the course archieve file"

Component Level- "The removed files should be stored in a separate folder as a backup whenever needed. The add and remove buttons should be placed at the bottom of the page"

The process carried out for the remaining requirements in this step is tracked in the excel sheet and provided below.

https://drive.google.com/open?id=0Bywub6ieBaBbQmgxYzNpaGVXVTg

All these steps carried are similar to the remaining requirements. The process carried out for the remaining requirements are provide in the excel sheet provided at the end of each step.

Article 2: "Cost-Value Approach"

As I have considered 10 requirements it is very difficult for me to show a sample example as how I have shown previously for the RAM model. Hence the implementation of all the requirements and proof of concept is shown in the excel sheets itself.

Step 1: Requirements are thoroughly observed and a total of 10 requirements are considered are as follows

Requirement No		Requirement Description
RQ1		As a system manager, I want the product to prevent unauthorized use by providing login option
RQ2		The system should provide a course chat room. It provides users to communicate with each other easily in the course

RQ3		As a user, I want to have a personalized view in the system, so that I am only presented with information that is relevant to me.
RQ4		When a user has successfully logged in, the product shall display the user's personal start page.
RQ5		When viewing a message, it shall be possible to reply directly to the message. This adds a new message with the same subject as the message currently viewed.
RQ6		The system should provide a search option. Helps the users to easily access the required information.
RQ7		If the user enters an incorrect user id and /or password the login page shall be reloaded with information showing that an incorrect login has been attempted
RQ8		The system should be able to provide popups/notifications.
RQ9		The user can register an account in the system through signup option.
RQ10		After successful registration, a unique system user id should be generated to the added users.

Step 2: Relative value

This step is carried out to find the relative value of all the candidate requirements from user's context and the values for pairs are taken from the article. The process carried out in this step is shown in the excel sheet.

https://drive.google.com/open?id=0Bywub6ieBaBbSndkaXVQSlZrZ0E

Step 3: Relative Cost

This step is carried out to find the relative cost of all the candidate requirements from developers' context and the values for pairs are taken from the article. The process carried out in this step is shown in the excel sheet.

https://drive.google.com/open?id=0Bywub6ieBaBbNkM1NlVZNi1tcmc

Step 4: cost-value graph

This step is carried out to find the value of each candidate requirement

Requirement No	Relative Value	Relative Cost	Cost value Ratio
RQ1	13	17	0.76
RQ2	13	12	1.08
RQ3	5	5	1
RQ4	7	5	1.4
RQ5	6	6	1
RQ6	19	15	1.27
RQ7	5	6	0.83
RQ8	9	10	0.9
RQ9	17	17	1
RQ10	5	17	0.29

Step 5:

In this the graph is divided into three categories based on the cost-value ratio as follows:

High above 2, Medium between 0.5 to 2, Low below 0.5

The total 10 candidate requirements are categorized into these three based on the cost-value ratio as follows:

Medium: RQ1, RQ2, RQ3, RQ4, RQ5, RQ6, RQ7, RQ8, RQ9

Low: RQ10

5. Lessons Learned:

Article 1:

As in the case of market-driven requirements, as the flow of requirements is continuous and from multiple stake holders and hence it is difficult to handle such a continuous flow. The RAM model described in this article helps to overcome this challenge as it includes four abstraction levels and each level is clearly described and differentiated and this model also connects the requirements at lower levels to the requirements at higher levels and hence helps to connect the requirements to the product strategies and also helps the developers to easily understand each and every requirement. Through the implementation of this technique, I have gained knowledge about how the upcoming requirements which are at different levels of abstraction are handled and clarified. I have faced few challenges and one of them is in the second step of RAM model (place), as there is a chance to place the requirements in any of the four levels, it has become difficult for me to decide which requirement is to be placed in which abstraction level. And in the third level (workup), I have faced difficulty to link the requirements together. I had overcome these challenges through the how-to-guide aid provided by the authors of this article.

Article 2:

The cost-value approach mainly deals with the prioritization of requirements and thus it helps to know which requirements should be given more priority and which requirements should be given least priority. Through the implementation of this technique, I have learnt how to prioritize the requirements practically and how the cost-value approach is carried out in the industries. I have faced few difficulties while applying this method. As this process deals with the mathematical calculations, it has become very difficult to calculate all the values for more number of requirements and as this prioritization is mainly based on AHP's pairwise comparison among the requirements, it has become difficult to compare as the number of requirements is increasing. As the values taken for paired requirements in this process are based on both the developers' view and users' view, I have faced problem to manage both the views as they are different from each other. This method failed to handle the interdependencies between the requirements.

6. Reflections:

Article 1:

As I have implemented this technique for only 16 requirements my observations may not be completely accurate. Hence to compare my observations with the observation of others who have implemented the technique in large scale, I have selected another article[3] and compared my observations with the observations of other authors. The authors of this article states that as we move upward from the component level to the product level requirements in the RAM, chances of creating the new requirements decreases. I agree with this observation as mostly the requirements at component level are suggested by the developers and are more detailed, it is difficult to directly link them to the product strategies. Most of my observations are similar to the observations of the authors of this paper. But some of the conclusions are not observed by me as I have considered only few requirements and did not apply it on large scale.

[3]   N. Muhammad, "Suitability of the Requirements Abstraction Model (RAM) Requirements for High Level System Testing," no. October, 2007.

Article 2:

As I have implemented this technique for only 10 requirements my observations may not be completely accurate. Hence to compare my observations with the observation of others who have implemented the technique in large scale, I have another article[4] along with this article[2] and compared my observations with the observations of the authors of that paper. The authors stated that the value and cost could be very complicated and could vary dramatically due to the stakeholders' different viewpoints. As I already specified previously, I have faced the same problem. By reading the other article completely, I have concluded that almost most of my observations are apt to the other researches. However, I didn't face the challenges which may occur due to the large number of requirements.

[4] N. R. Mead and S. Engineering, "Requirements Prioritization Case Study Using AHP," no. September, pp. 1–11, 2008.