Method Description: "Agile Requirements Prioritization: What Happens in Practice and What Is Described in Literature"

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1 Introduction

Agile software development consists of a multitude of iterations in between which the decision what requirements to implement is re-evaluated by a process of requirements re-prioritization. In 2010, Racheva, Daneva, Herrmann, and Wieringa (2010a) examined 22 different Requirements Prioritization (RP) methods and extracted an abstracted, conceptual model of of the RP process from a generic perspective. Four months later, Racheva, Daneva, and Herrmann (2010b) present an improved version of this model based on a case study among 11 practitioners of companies that follow agile methodologies. The paper discussed in this method description (Bakalova, Daneva, Herrmann, & Wieringa, 2011) presents the same improved version of this model. In fact, a majority of this paper is identical to Racheva et al. (2010b), with the addition of mapping the concepts of the aforementioned 22 RP methods to the aspects of the improved model.

The end-goal of the method is to inform decision-makers (clients) of the important concepts that are considered during a RP iteration by practitioners. In the end, this information helps the client in three ways: 

(i) to navigate through the agile process of delivering business value; 
(ii) to make explicit the tacit assumptions in different RP methods; 
(iii) to identify those possible pieces/sources of information important to the outcome of the prioritization and, consequently, to the project.

The method consists of eight aspects that clients consider when making decisions on requirements priorities: (1) **Project Context** consisting of project settings such as ‘project size’ or ‘size of the client’s organization’, which also has a significant impact on (2) **Prioritization Criteria** together with estimated **Business Value**, (3) **Estimated Size** - broken down into functional size of a requirement and a size/effort estimation, (4) **Input from the Developer** providing advice and alternative solutions, (5) **External Change** represents events during the project that impact the company, business environment or product, (6) **Learning Experiences** comprises of new insights acquired by the client and/or the developers, (7) **Project Constraints** such as release date or budget and (8) **Dependencies** between requirements both architectural or chronological. Figure 1 connects all aspects to the relevant steps in a RP process.

The authors of this paper are Zornitza Bakalova, Maya Daneva and Roel Wieringa of the Computer Science Department of the University of Twente together with Andrea Herrmann of Axivion GmbH. Bakalova is a PhD doing research into Agile Software Development with a focus on Requirements Engineering. To complicate things, she recently changed her name from Racheva. As a result the main author of the two publications cited first in this article is identical to Bakolova. Daneva is an Assistant Professor mainly doing research into Requirements Engineering. To complicate things, she recently changed her name from Racheva. As a result the main author of the two publications cited first in this article is identical to Bakalova. Daneva is an Assistant Professor mainly doing research into Requirements Engineering. Roel Wieringa is a Full Professor and head of the CS Department doing research on a diverse range of topics related to IS. Axivion GmbH, the company Andrea Hermann works for, is a German spin-off company of the University of Stuttgart that sells the commercial version of a software product to stop software erosion, developed in collaboration with the University of Bremen. However, according to her LinkedIn profile, Andrea Hermann has been a private lecturer at the University of Heidelberg since 2004. As a consequence. She has accumulated 37 publications to date and actively contributes to the Requirements Engineering field.
2 Example

Due to the goal of the authors, the method discussed in this report is a meta-model of RP in general. Although applying the method to a real-world agile environment is possible, the authors refrain from discussing this specific use case. Instead, they map the concepts of their model to the 22 prioritization methods identified in Racheva et al. (2010a). This section duplicates a fraction of this work by discussing the process of one RP method and identifying the steps that are comparable to concepts of the discussed model.

Wiegers Matrix Approach (Wiegers, 1999) calculates relative priority scores for a list of requirements by estimating four Prioritization Criteria. This RP method was chosen because it contains the largest absolute number of comparable concepts and the initial paper is available to anyone. Step 1 of Wiegers Matrix approach is the creation of a Project Backlog which lists all requirements, features or use cases that require prioritization. Second, the relative benefit to the customer is estimated on a 1 to 9 scale. Inversely, step 3 estimates the penalty if the feature is not included in the end product. Step 4 calculates the sum of step 2 and 3 and subsequently divides this figure by the total value of all requirements. The result is a representation of the Value of Requirement in percentage. In step 5 and 6, Input From Developers is leveraged to estimate the relative cost of implementing each feature and the relative degree of technical or other risk associated with each feature. Both are normalized in percentage of the total value, resulting in a relative Size/Effort Estimation. In step 7, depending on Project Context, the participants of the prioritization process assign weights to each of the former steps. Subsequently, the priority number is calculated as value %/ (cost % * cost weight + risk % * risk weight) so the participants can list the features in descending order by priority in step 8. Depending on Project Constraints the customer and developer representatives review and adjust the final list.

This assessment facilitates the creation of an example deliverable. Wiegers Matrix Approach contains 7 out of 10 concepts of the discussed method, each of which has received a grey background in Table 1. Project Backlog and Value of Requirement are not part of the eight aspects that influence the RP process. However, the creators include them because they are deliverables of a multitude of RP methods. Furthermore, the authors consider two project backlog variations to be out of scope of their paper but include them in the comparison. Because Wiegers Matrix Approach does not include these variations, they have been omitted from Table 1.

<table>
<thead>
<tr>
<th>Project Context</th>
<th>Prioritization Criteria</th>
<th>Size/Effort Estimation</th>
<th>Input From Developers</th>
<th>External Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning Experiences</td>
<td>Project Constraints</td>
<td>Dependencies</td>
<td>Project Backlog</td>
<td>Value of Requirement</td>
</tr>
</tbody>
</table>

Table 1: Model Concepts Available in Wieger’s Matrix Approach

3 Related Literature

Arguably, the earliest reference of Agile Requirements Prioritization in the form of incremental development and evolutionary advancement dates back to a report from Zurcher and Randell (1968), describing a design process consisting of a base-system which is sequentially expanded with an increasing amount of function and detail. Nevertheless, the first accepted formalization of prioritized development cycles by risk did not appear until Boehm (1986) introduced the ”Spiral Model of Software Development and Enhancement” for risk-driven-iterations; a method to determine the priority of requirements in iterative and incremental development (IID). Since the Agile Manifesto was released (Beck et al., 2001), a variety of earlier development approaches are now referred to as agile methodologies (Larman, 2004). As a consequence, the new field of Requirements Prioritization encapsulates many accredited, recognized prioritization methods. For instance, Analytic Hierarchy Process (AHP) was developed by Saaty (1980) and the XP planning game was first introduced in 1999 (Beck, 1999). In the years following the release of the Agile Manifesto, several authors conducted research into Agile Requirements Prioritization methods. For instance, Paetsch, Eberlein, and Maurer (2003) compare Agile Requirements Engineering to traditional RE and found that, in comparison, agile methods are "described vary[sic] vaguely and the actual implementation is left to the developers". Berander and Andrews (2005) provide a general overview of RP techniques and compare five RP
methods on scale, granularity and sophistication. The authors proceed to recommend to use the simplest appropriate method in general and only use more sophisticated ones to resolve disagreements or supporting critical decisions. Cao and Ramesh (2008) finds that, in practice, organizations that practice Agile Development already apply multiple RP methods during a project. Nevertheless, Racheva et al. (2010a) noticed that “researchers in Agile RE case studies found that the creation of software product value through requirements prioritization decision making is only partly understood. (Barney, Aurum, & Wohlin, 2008; Petersen & Wohlin, 2009) and “a generic conceptual model describing requirements reprioritization in agile development is missing”, in order to proceed to fill that gap by proposing the first version of the method described in this paper.

None of the three publications that introduce different versions of the discussed method have accumulated citations that apply the method in a case study or another RP method. The latter is a consequence of the origin of the method, which is based on a review of all RP methods known in academic literature. Although practitioners might apply the method in their day to day operations, there is no way to confirm whether this happens due to the lack of a name for the method. Based on (Racheva et al., 2010b) identification of the importance and varying perception of business value in academia and business, Heidenberg, Weijola, Mikkonen, and Porres (2012) propose a method to model business value itself.

References


There are many other publications that compare single RP methods to one another. Due to the numerical size of RP methods the discussed paper is based on, these have been omitted from this section.


