Product Backlog Prioritization in Scrum: A Review

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Abstract: Scrum is emerged as one of the flexible and lightweight agile approach in IT industry. The key element of its flexibility is evolving requirements and delivery of business value in small releases. Identification of correct candidate requirement (which is most likely to be included in sprint backlog) for a certain release is necessary to deliver highest business value early. Prioritization is an effective way to identify correct candidate requirements. However, in scrum, prioritization is not static and easy process as in traditional development methodologies because of evolving requirements. To prioritize requirements there are different techniques which have been explained in literature. Different techniques consider different factors for prioritization. Value-based prioritization is the best technique which is used in scrum. In this paper a narrative review has been done to explain factors which are considered for prioritization. A small survey has been done to find the answers of questions which arose during literature study.

Keywords: Scrum, Prioritization, Product Backlog, Value-Based.

I. INTRODUCTION

Software systems have become the backbone of almost all business operations. Advancement in technology and business needs force customer to evolve their project requirements day by day. Evolving requirements is a big challenge in software development. Agile methodology is the best solution to work with such evolving requirements. Scrum is one of the efficient agile methodologies to provide flexibility in development. Scrum follows incremental and iterative approach to provide delivery of valuable product features in several releases. Product backlog items which have to implement are prioritized. Prioritization is difficult and ongoing task in scrum because of evolving requirements. Ignorance of any crucial product backlog item can make the customer unsatisfied. Therefore prioritization process is the core activity in scrum and should be done carefully.

This paper is intended to review the prioritization in scrum. The review has been conducted through literature survey. The objectives of this review paper are:

1. To identify the factors for the selection of product backlog items during prioritization process.
2. To answer the questions that arose during literature survey.

This paper has been arranged into five sections. Related work has been given in section 2. Section 3 which is entitled as “Discussions” has divided into three sub-sections describes the product backlog, prioritization and factors respectively. Result of survey has been given in Section 4. In the Section 5, the conclusion and future work has been given.

II. RELATED WORK

Many researchers have presented the Agile Requirement Engineering. Traditional development focuses on gathering and analyzing requirements before going to design phase. However, Agile welcomes the changing requirements even late in the development lifecycle. A.D. Lucia and A.Qusef has surveyed the real processes and activities of agile requirement engineering. Customer collaboration, good agile developers and experienced project managers are the secret of success of agile requirement engineering. [15]

M.Kumar et al. has provided a hybrid approach for agile requirement engineering with the help of Joint Application Development (JAD) and viewpoints. JAD and viewpoints serves as a key tool for requirement gathering. The aim of hybrid approach is to serve the purpose of agile requirements. [9]

A.Batool et al. has proposed a conceptual framework. The emphasis of conceptual framework is to make the requirement process more effective. This framework also minimizes the complexities and barriers faced during the traditional requirement engineering process. [5]

H.Elshandidy, S.Mazen has provided a requirement engineering task in agile and traditional methodologies. Requirement elicitation, Requirement Analysis and negotiation, Requirement modeling, Requirement Validation and Requirement management are the five requirement engineering tasks. By comparing these tasks, it is concluded that by bringing agile into world of requirement engineering will guarantee a greater and a faster success. There are many promising requirement engineering research areas in which agile can be perfectly fit. These areas are solving problems related to variability and component reuse in SPL, verifying models of adaptive systems, or developing tools/approaches/techniques/patterns to help taking technologies from research to practice. [6]
A. IQbal et al. have analyzed AHP (Analytical Hierarchical Process), SERUM (Software Engineering Risk: Understanding and Management), EVOLVE and VOP methods that are used for requirement prioritization with the different factors such as cost, value, risk, benefit, dependency constraint etc. They concluded that there is no single technique that addresses all these factors. The proposed approach addresses all the factors for prioritization. After dependency constraint check the requirements reach at second step where they prioritized by using VOP. The output of this step is a set of requirements that should be implemented in current release. However, there are other factors too that should also considered. Implementation effort, resource constraint and benefit factor addresses by the step three, four and five. [18]

Selection of group of important requirement to be implemented in iterations is achieved by continuous requirement prioritization. R.H.AL-Ta’ani et al. has proposed a conceptual framework that outlines the factors and activities involved in the requirement prioritization process. [7]

R.Popli et al. has proposed importance and effort related factors. Prioritization of user-stories is highly dependent on the value of these factors. The relation of importance and effort has been calculated to decide the priority of user-story. [2]

III. DISCUSSIONS

A. Product Backlog

Product backlog is one of the crucial artifacts in scrum. It is the prioritized list of requirements for the product to be developed. It is dynamic artifact in scrum because it evolves throughout the scrum process. Change in customer requirements and environment in which product will be used causes evolving of product backlog. The requirements in product backlog are called product backlog items and can be enhancement, bug and new user-story. Product owner, who is the representative of customer, has a responsibility to create and keep the product backlog updated.

B. Prioritization

Scrum focuses on customer satisfaction by providing the business value early. However, ignorance of criticality of user-stories will result in unsatisfied customer [2]. Prioritization is the process of determining the inclusion of candidate requirement in the certain release [15]. Value-based prioritization is the core principle of scrum. These different techniques consider different factors for prioritization. Requirement prioritization facilitates requirement engineering process by providing:

1. Improvement in customer satisfaction
2. Constraint management
3. Focused product backlog delivery
4. Risk reduction

There are different prioritization techniques which consider different factors for prioritization. Scrum uses Value-Based prioritization technique to arrange the product backlog items. Product backlog items which are highly valuable and important for customer are kept at the top of product backlog item. Along with business value of product backlog item other factors such as dependencies, risk, cost, availability of resources are also taken into account during prioritizing. These all factors have been described in Sub Section C.

C. Factors for Prioritization

1) Business Value

Business value is an importance related factor [2] which is used to prioritize the requirements in scrum. Business value is the estimation of money will be provided by the user-story to organization. Higher the business value higher will be the priority of requirement. Business value can be estimated with two following concepts:

a) Positive business value

Positive business value is equivalent to the profit that will earn in business by delivery of important requirement.

b) Negative business value

If important requirement is missing its business value will goes negative instead of being zero [16]. Therefore consideration of negative value is also important as positive business value.

2) Cost

Cost is also the big concern in prioritization process. It is calculated in terms of money. The requirements that project can afford to implement first, may have highest priority [18]. Cost-benefit analysis can be used for the prioritization.

Cost is also utilized for the calculation of Return On Investment (ROI). Sometimes the customer and the organization may decide to move important feature (that could
give higher ROI) lower down the priority list just because the amount of effort required to develop it.

3) Risk
The high risks user-stories assign with high priority. This ensures that changes in requirement can be caught early in project. As soon the team will be able to mitigate the unknowns, thus they will able to remove uncertainty, thus they will lead to a higher-quality product [3].

4) Dependencies
Dependency between requirements also affects the prioritization. Dependency means the requirement or set of requirements is dependent on another requirement or set of requirements [18]. Let us suppose that there are two Features A and Feature B. Feature A has three sub-stories one of which is dependent on feature B. Feature B itself has two sub-stories. Customer has give the higher priority to feature A. If developer team thinks they should develop the first two (non-dependent) sub-stories out of the three for Feature A, they need to talk to the PO and customer and discuss whether that will deliver sufficient value. If they say yes, then deliver feature A with two sub-stories. But if delivering two sub-stories from Feature A is not delivering value to the customer, then move Feature B to the top of the product backlog, which will remove the dependency of that third Feature A sub-story [12].

There are two types of dependency constraints known as Precedence Constraints, Coupling Constraints. Precedence constraint occurs for the requirements that can be start implementing after the complete implementation of another requirement on which they are dependent. However, coupling constraint occurs for the requirements that must implement in the same increment [18].

5) Resources
Resources are the budget, staff, schedule and technology which are necessary for effective operation [2, 18]. Resource is one of the important factors which impact the prioritization. Unavailability of particular resource at time can lead the task towards delay. Therefore it should also be considered during prioritization.

6) Security
Security can be considered as network security, code security, documentation security and functional security based on customer requirements [2]. Security is a constraint which can impact the prioritization of product backlog item. Security must be taken as higher priority factor.

IV. RESULTS OF SURVEY
An online survey by questionnaire has taken to find the answers of questions which arose during literature study. Total 14 questions was included in Questionnaire and sent to 10 respondents via email. Among 10 respondent 8 has given the response which has been collected in spread sheet format.

From 14 questions, only 5 questions have been extracted which are related to the objective of this review paper. The summary of these questions have given in bar chart Error! Reference source not found.. X-axis of bar chart represent the questions and Y-axis represent the number of respondent response for particular option (Strongly Agree, Agree, Disagree, Strongly disagree).Five question and the percentage of agreed respondents has given in Table 1.

![Figure 2. Summary of Survey](image)

<table>
<thead>
<tr>
<th>Sno.</th>
<th>Question</th>
<th>Respondent Agreed (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1</td>
<td>Product backlog item represent as user-story format “As a user I want……………..so that…………….”.</td>
<td>75%</td>
</tr>
<tr>
<td>Q2</td>
<td>Story points of user-stories change during grooming and sprint backlog meeting?</td>
<td>75%</td>
</tr>
<tr>
<td>Q3</td>
<td>The priority of user-story will increase if it is a bug.</td>
<td>87.5%</td>
</tr>
<tr>
<td>Q4</td>
<td>The priority will increase if the product backlog item is highly refined during grooming and sprint planning meeting.</td>
<td>75%</td>
</tr>
<tr>
<td>Q5</td>
<td>The priority of user-story will increase if a reusable code is exists from previous projects.</td>
<td>87.5%</td>
</tr>
</tbody>
</table>

V. CONCLUSION AND FUTURE WORK

From the review it has been concluded that prioritization of items in product backlog plays a vital role to deliver business value in small releases. During Literature study it has also been observed that maturity of requirement is not considering as important factor for prioritization. Prioritization of immature requirements can be the wastages of time. In Future work, we are going to propose a new factor called maturity of items of product backlog. This factor can also impact the prioritization of product backlog.
REFERENCES


