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Case Study On Agile User Stories Prioritization Using Imaginative Standard

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Abstract

Aim of Agile User Stories Prioritization engineering actions are contribute to business value that is described in terms of return-on-investment of software product and it is very essential for a software. For a product to be successful, it is very important to identify the correct equalizer among the competing quality User Stories. From the customers' view, the action of continuous User Stories prioritization creates the very core of today's agile process. In this paper we deliver several case studies on Agile User Stories Prioritization (AUSP) methods to afford a conceptual model for understanding the inter-iteration prioritization approach in terms of inputs and outcomes, and finds problem and solutions pertinent to Agile User Stories Prioritization.

Keywords: Agile development, requirements prioritization, Agile User Stories Prioritization engineering, inter-iteration decision-making process, value based approach, exploratory case study.

1. INTRODUCTION

Continuous requirements prioritization process from the customer's scope of vision forms the essential of today's agile approaches. An essential feature of any agile approach is an expressed focus on making business value for the customer [1]. Agile software process practitioners deem this approach especially valuable for the software producers in a circumstance that admits extremely uncertain requirements, experimentation with fresh development technology, and customers willing to explore the ways in which developing product can assist their business goals.

While exhibiting the project to as low a danger as potential. Awesomely, researchers [7, 8] in Agile User Story Engineering case studies also identified that the creation of software product value through requirements prioritization decision making is only partially realized. These two characteristics of Agile User Story Engineering pose at least two disputes:

1. Continuous reprioritization more frequently than not leads to project imbalance, and
2. Customers, by and large, relate the concept of business value to characteristics that meet their functional requirements, so non-functional

Requirements that might initially seem secondary to customers turn out critical for the operational success of the product. Re-implementing the architecture of the software product at the later stage would add up to an over-expensive or a delayed project.

It suggests a conceptual model of the Agile User Stories Prioritization Process from customer's scope of vision. We make the note that we furnish a new prioritization technique and we

1. Redefine our view of requirements and their (re)prioritization by addressing them from a customers' scope of vision, and
2. We suggest a model that reflects this particular focus and demonstrates unified process to discussing the prioritization attempt independently from the particular method that is used. These permits the customers to spot concealed issues ahead of time enough in the project, and assists them make the prioritization decisions.

Essentially, in agile software projects, the development process is a value creation process that depends on active customer participation. The business value creation is checked both through the final product as well as through the process itself. As previous studies show [2], the continuous prioritization of requirements during the project acts as fundamental role in accomplishing business value creation. Requirements (re)prioritization at inter-iteration time is the means to align expert decisions to the business strategy that aims the business value. Requirements engineering is a decision-centric process [5], and decision support plays a vital role in enabling the delivery of business value to customers [6]. Hence, decision support is crucial in accomplishing value to customers.

In this paper, we demonstrate an empirical investigation of this phenomenon by means of an exploratory case study. Using a conceptual framework for Agile User Stories Prioritization that developed earlier [3], we investigated real-world cases in companies. The overall research objective was to uncover how mid-course requirements prioritization aims in industry and what beliefs of business value are included in it. The case study is motivated by previously published results [3] from a systematic literature review on prioritization methods in agile projects. This paper is a step towards understanding how Agile projects produce business

value to the customers or to the product owners through the requirements prioritization activity. We have set out to answer the following research questions (RQs):

RQ1: Which roles and responsibility are involved in the requirement prioritization process decision-making?

RQ2: How companies are using business value-driven decisions in Agile User Story prioritization?

RQ3: Which are the fundamental futures to the requirement prioritizing process from customer's perspective in Agile projects?

RQ4: What are the main characteristics of the project settings for the Software requirements prioritization process?

RQ5: What are the other project values adds from the requirements prioritization process? We answer it by expressing out an exploratory multiple case studies. This research constitutes a further step to contribute to the understanding of Agile User Stories reprioritization at inter-iteration time.

This paper is structured as follows: section 2 motivate this research in more detail and furnish background on related work in the field of Agile value-driven requirements prioritization engineering. Section 3 reviews related work on business value-driven requirements prioritization engineering methods, used in Agile software development, Section 4 presents the results and assesses our answers to the research questions and discusses implications for researchers and practitioners, Section 5 summarizes future research directions that we identified based on the case study and concludes the paper.

2. LITERATURE REVIEW

In this related work subdivision summarizes on the state of study with regard to the reply to our five research questions specified in the introduction. To the best of our knowledge, there is no systematic empirical research around how requirements prioritization process is really executed in agile projects.

Our main objectives for designing a model of Agile User Stories Prioritization from a customer view arises from the practices of continuous requirements prioritization, with firm customer participation, are a comparatively recent phenomenon and accordingly are only partly understood. As the Agile literature [9, 10, 11] suggests, never earlier in the software engineering history, the customer has been that actively and reliably needed in the requirements prioritization as he/she in Agile software development.

The Agile manifesto [13] place the customer's role is very vital in making decisions around "what to build". In the minimalist philosophy of XP, a prominent agile process, the following is encouraged for the customer's role [12]:

1. The customer is an integral component of the team and should be on-site with the team.
2. The customer provides user stories and then talks about each requirement directly with team member.
3. The customer is responsible for all business decisions including prioritizing user stories development.
4. The small 2-3 week iterations permit the user to acquire their requirements established on concrete working software.
5. The customer regularly tests the software to verify it works as expected.

To illustrate how agile projects continue, we describe below an example of how Scrum [15, 16] treats requirements prioritization. Scrum is an iterative and agile incremental process model including values, artifacts, roles and meetings. The main roles in Scrum are:

1. The "Scrum Master", who assures that the Scrum process is used as aimed and who enforces the project management practices;
2. The "Product Owner", who symbolizes the stakeholders;
3. The "Team", a cross-operational group who execute the work activities as the actual analysis, design, implementation, testing.

Agile approaches explicitly aim to deliver business value to the customer early and regularly across the complete project [17, 12, 14]. In this way, the return on investment can be generated much earlier in the development process. A fundamental practice of Agile development contributes to this early business value delivery is the continuous and business value-driven requirements prioritization from customer's view. The project commences with a product backlog which is an initial requirements list and is prioritized by business value. It also comprises approximate estimations of development effort. Business value is determined by the Product Owner and development effort is determine by the Team. Each repetition commences with a sprint backlog which comprises only those requirements which are to be implemented during this sprint. We make sure the sprint backlog is frozen and not altered until the sprint is complete. This means that (i) reprioritization happens on the sprint planning meeting at the beginning of each sprint only, and (ii) later on this time no re-prioritization happens on the daily Scrum meeting. At this meeting, business values driven and development effort of the requirements are re-estimated and the sprint backlog for the next sprint is designed. At the end of a sprint cycle, two meetings are held: the "Sprint Review Meeting" (where the completed work is presented to the stakeholders) and the "Sprint Retrospective" (which serves the objective to make continuous process improvements). Surprisingly, researchers in Agile User Stories engineering case studies establish that the creation of software product value through requirements

prioritization decision-making is only partly understood [7, 8].

RQ1: Which roles and responsibility are involved in the requirement prioritization process decision-making? The Agile manifesto [13] holds the collaboration with the customer vital. XP [12], a prominent agile process, encourages that the customer is responsible for all business value decisions making, including requirements prioritization. Even though decentralized decision-making involving all team members [2] is a contributing principle in agile development, it is the customer who builds the final decisions. The customer is represented by a so-called 'on-site customer'. In the decision-making process across requirements priorities, the development team aims the role of consultant by estimating budget and guessing technical risk.

RQ2: How companies are using business value-driven decisions in Agile User Story prioritization? Aurum and Wohlin [18] recommend a value-based process, which in important across coordinating customer's requirements, business requirements and technical prospects when creating requirements prioritization decisions. For example, a recent study by Barney et al. [7] investigated the release planning process to make software product value through requirements selection. These authors discovered the elements that decide the decisions across inclusion of certain requirements for implementation. They are the customer and market base of the software product, along with circumstance factors such as maturity of the product, the marketplace in which it survives, and the development tools and methods available.

RQ3: Which are the key futures to the requirement prioritizing process from customer's view in agile projects? To answer it, we apply a grounded-theory-based research method [19].

RQ4: What are the main characteristics of the project settings for the Software requirements prioritization process? The background across agile development talks about two characteristics of the product circumstance which determine decision-making: change and project constraints. Alteration is explicitly required and welcomed by Agile development methods ("embrace change" [12]), or vice versa, Agile approaches are selected in circumstances where alteration are high [20, 8] as they assist to manage with this position and enforce schemes which cut down the budgets of alter [2]. Project constraints like the determined limited resources and time pressure are distinctive for Agile and non-Agile projects. In more prominent projects however, prioritization must be done on a higher abstraction level [20] than in small projects.

RQ5: What are the other project values adds from the requirements prioritization process? The introduction of risk management in the development process and improving communication [20] are two of the objectives of Agile and iterative development. The primary types of risk which Agile/iterative development aims to mitigate are change/volatility and uncertainty [8]. Change means the introduction of new requirements or the alteration of existing ones, which can be induced by discovering and by external change. Uncertainty can be subordinate to instability of requirements or lack of technical experience, both of which lead to uncertain budget estimation.

3. REVIEW OF ARP TECHNIQUES AND PROCESS

The analysis was persuaded out using a case study [4] to explore and develop the decision-making process throughout a project in the circumstance of agile projects and changing requirements. Clearly, requirements prioritization process is a component of any project, independently from the development method. One of the greatest assets of an agile approach is that business value is handed over to the customer throughout the project, and the return on investment is generated much earlier. Thus any alter in the requirements can be taken into consideration and implemented into the product at an early stage. This highlights the paramount importance of the requirements prioritization, activities.

The alter in the backlog with requirements for iteration may happen for different concludes – new market or company realities or better knowledge about the business value certain features deliver. This involves an active prioritization process as well. This perspective is confirmed by Harris and Cohn [14], who apply tactics to reduce the budgets and increase the profits through strategic learning and furnish road map on how to optimize business value. They demonstrate the essential of espousing an active approach to Agile User Stories Prioritization, in order to take into consideration the essential prospect of learning in an agile project. Their focus is especially on integrating learning and budgets of change in the decision-making process.

3.1. The case study process and participants

We performed an investigative case study by performing the following steps:

1. Comprise a survey,
2. Confirm the survey over an knowledgeable researcher,
3. Implement alterations in the survey established on the advice,
4. Do a pilot conference to check the applicability of the survey to realistic perspective,
5. Carry out semi-structured conferences with specialists affording to the confirmed survey,

6. Illustration (continuation with those contributors that keep deeper awareness or additional specific perception).

Every examinee was provided beforehand with evidence on the research determination, the research course and the privileges and duties of the contributing case study companies. At the conference, the researcher and the examinee walked over the survey which assisted to leader the interviews. The survey was self-possessed of three parts: the first part deliberated the prioritization process repetition that each interviewee experienced in one concrete project. The second part comprehensive familiarity of the interviewees with esteem to Agile User Story Prioritization Process across many projects, and the third part involved queries associated to the business value insight and value creation, as crucial part of the prioritization decisions. The motivation behind this structure was to focus the attention of the contributors on a concrete example and then make a conversion to general observations drawn from participation in other agile projects. The third part intended to simplify the concerns of business value as a part of the prioritization decision-making process. We create two notes:

1. No extensive alterations in both the questionnaire and case study protocol took place after the pilot interview, so that the pilot interview could be considered part of the case study.
2. During the interviews there were cases when other queries arose next to those involved in the questionnaire. These queries were not previously projected; however the researcher piloting the study considered them interesting and pursued the interview in that direction.

The application domains for which these experts developed software resolutions represent a rich mix of arenas comprising banking, health care management, automotive industry, content management, online municipality services, and ERP for small businesses. In each organization we interviewed one or more councils that were directly involved in the decision-making and the development process. Many of the contributors accomplished numerous roles in the team and thus had a comprehensive experience to the entire process. The information about the contributing companies and professionals is concise below:

1. Middle-sized one company in the India (2 cases, 3 contestants)
2. Small-sized two companies in the USA (3 cases, 3 contestants)
3. Small-sized one company in China (1 contestant)
4. Middle-sized one company in Australia (1 contestant)
5. University one (1 scholar project)
6. Big-sized one consultancy in US (1 contestant)
7. One IT department in a big governmental organization in India (1 contestant)

We deliberate 8 companies and discussed the total of 10 projects, with 10 customer organizations.

3.2. The data analysis

In this revision, the statistics used and continuously associated to the evolving model is literature on Agile User Stories Prioritization existing via scientific digital libraries and prominent agile experts' journals. We did a semi-systematic literature search using the five bibliographic databases: IEEExplore, ACM Digital Library, Google Scholar, InterScience and Citeseer. We accompanied them with the following journals: the Agile Journal [9], and the stands, committed to software development and Agile approaches: DrDobb's [21] and InfoQ [20]. The significant arguments we used for our search were: Agile, requirements, backlog, prioritization, inter-iteration, decision-making, business value, risk, cost, features. We sketched the orientations in the recognized papers to get access to other pertinent sources.

Our evaluation uses the below technique to deliver our case study. Below we emphasized each of them in terms of its core headings and context of use

1. Planning Poker[36]
2. Ranking based on product definition [24]
3. Planning Game[12]
4. Quality functional deployment QFD [23, 26]
5. Wiegers' matrix approach. Karl E. Wiegers [32]
6. Mathematical programming techniques [28]
7. MoSCoW [25]
8. Pair-wise analysis [26]
9. Weighted criteria analysis [26]
10. Analytic Hierarchy Process (AHP [30]
11. Dot voting [26]
12. Binary Search Tree (BST) [22]
13. $100 allocation (cumulative voting) [27]
14. Multi-voting system [31]
15. Ping Pong Balls [16]
16. Round-the-group prioritization [11]

In addition to the above practices, our literature review exposed one practice, which cannot be preserved as distinct method or technique, as it might be applied in combination with any other technique - the practice of bucketing requirements [29]. This mean's "bucketing" groups of main functionality or areas of task support are occasionally easier than feature by feature prioritization. The above techniques we've recognized can be considered in two main clusters:

1. Techniques, straight associating requirements pairwise
2. Techniques that group requirements dependent on their significance.

4. CASE STUDY CONSEQUENCES

At the commencement of repetition business value of every story has to be predictable (calculated). The challenge is to make the awareness or evidence, used by the specialists to execute the predictable,

clear. The foundations of such evidence need to be recognized, as well as the principles that describe one requirement as additional treasured than another. In order to create the decision-makers responsive of the forces, essential the value of a story, we recommend that the succeeding extra constraints to be involved to the story:

1. Points among siblings - involved by the customer based the hierarchy with stories (e.g. WBS) and on proficient understanding. These influences to comprise marketing or other domain specialist.
2. Dependencies - utmost of the approaches defined above typically do not yield into story dependencies among requirements. Those approaches which do recognize for dependencies are the ones which define requirements on numerous ranks of granularity.
3. Confidence parameter - the confidence around the essential to implement the story at the existing instant - this is a utility of the story's value and volatility, and replicates the level of evidence the customer has around the value of the essential functionality and the possibility that the story is affected by alteration in the environment. This influence force is a percentage or a number on a scale. Thus we address Harris and Cohn's [14] suggestion to submit stories with extraordinary predictable budget of alteration - the ones that are extra probable to be altered can be delayed until extra and enhanced understanding around how (or even whether) to improve them is expanded and responses knowledge also touches with the responses recommended by G. Ruhe et all [35].

Particular user stories do not generate business value straight but they are precondition for other stories as we recognized two potential solutions to conduct the dependencies:

1. Deliberate such user stories as married to the story that generates (max) business value, or to wrap these stories as a bundle - from external is only one story noticeable, that is, separation is not thinkable.
2. Familiarize story points inside the stories of a feature. This would mean that stories with larger points will have to be implemented beforehand the others, nevertheless of their business value.

The excellence attributes cannot be detached from other stories and to deliberate them as functional requirement, where the key principles are the confidence parameter. For example, if the customer recognizes for sure, that the system will have numerous thousands users, the scalability will be addressed at earlier phase.

The business value of a requirement is diverse at diverse points in period. That is, it differs throughout the project, as fresh evidence strength attains, alterations in the market condition strength happen, thus touching the understanding the team has around the value of a story. Moreover, the requirements volatility will involve refactoring or rework, and the estimations for these accomplishments have to be engaged into deliberation when scheming the business value. These accomplishments are secreted for the customer, as they are not obviously involved in the project's backlog or work breakdown structure; they don't deliver functionality and, correspondingly, don't produce business value. Estimation is executed vigorously every period prioritization occurs. This innovative suggestion addresses the opinion prepared by other authors [2] that in Agile situation the execution instruction is founded mostly on the business value. We need recognize nevertheless, that at this point of period, we do not have any empirical data which recommends an exact formula of the association among the preliminary business value and budget, and the business value at succeeding repetitions.

Determining on a prioritization practice in Agile projects will be contingent on the project's situation, the preceding skill and understanding of the project. We can deliberate at least the succeeding principles when selecting a prioritization method:

1. Quantity of objects to be prioritized,
2. Quantity of stakeholders involved,
3. Level of requirements instability,
4. Foundations of evidence accessible.

A study by Karlson et al [33] establishes that the two specific approaches, associated created on 'ease-to-use' and 'time consumption' of the practice, do not diverge the considerably concerning accuracy. Describing the possibility of subsequent repetition will depend on estimated existing value of the requirements, and the quantity of effort that the developer is able to execute in repetition (for example measured in story points).

We progressed on real world case study in Software Company in demand to answer our research questions (RQs) to assess the success factor of the product as surveys.

RQ1: Which roles and responsibility are involved in the requirement prioritization process decision-making?

In our case study the developer plays a greatly extra significant role in practice than what is suggested in the literature. Overall, the specialists granted that the developers and testers are active contestants in the requirements decision-making processes, even nevertheless the customer had significant earlier knowledge in software development projects. We detected the subsequent circumstances:

1. The decisions were delegated fully to the developers and testers.
2. The customers required alterations or quicker execution of certain functionality, without contributing in other prioritization actions.

3. The customers contributed during the project in a traditional way, e.g. by appreciative alterations to budget.

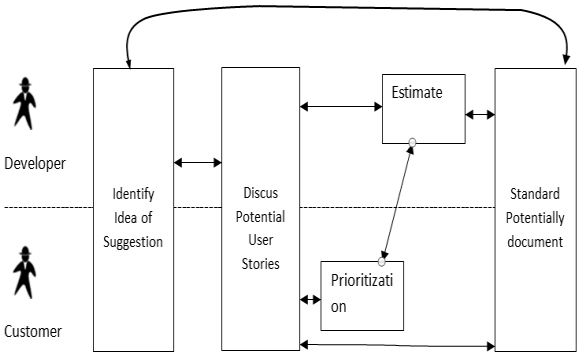

Fig. 1. Role and Responsibility involved in the requirement prioritization

We observed that the contribution of the developers in the decision-making processes is stronger in minor projects as shown Fig. 1, where the customer is a minor organization or company. First, such customers don't own knowledge in the IT domain and can't have enough money compensating extra for IT consulting services. They may even discovery it very expensive to assign a resource to the role of 'on-site customer'. In such a situation, it occurs that the customer representatives the decisions influencing the value creation, to the developing team. In one of the projects that we investigated the developers acquired over the decision-making since the customer didn't own the time and capabilities to systematically motive around the system him/her desirable. This makes us consider that there are definite patterns of appropriate influences that will always lead to delegating the decisions to the developing organization. The developers own knowledge both in development and in the particular subject area, as teams are focused in developing a specific class of applications (e.g. banking, health-care, ERP, etc.). In the involvement of our interviewees "this indications to high customer fulfillment and virtuous association with the customer, who will, ultimately, lead to prospect mutual projects". One project manager described: "Customer's relations are important; we need to make them happy but we don't just do whatsoever they ask for. Instead, we try to recognize what their problems are, and their field, so that developer can better assist their wants". In this view, the developers' company is the one to make assured that the project delivery process runs in a way that is cost-effective for the company. If developers accommodate all desires which customers influence come up with at inter-iteration time, the company may discovery it not maintainable in the extended run. This surveillance increases the query about value deliberations for the developers, deliberated in detail [31]. The matter that developers powerfully contribute in the prioritization and decision-making gives us the suggestion that Agile and traditional requirements engineering processes may not be that different regarding that prioritizes the requirements.

The customer's judgment of significance concerning a specific requirement might not continuously be representative for the customer's organization as a comprehensive. The customer consciously or unconsciously influences the developers to implement specific requirements. The developer has no opportunity to accumulate extra objective evidence about the condition and to justice the extent to which s/he could belief the customer's intelligence of priorities. One contestant described her/him knowledge in a case of a customer who asked for a certain report. According to the customer, this report was 'very important'. It acquired significant efforts on the developers' side to make it. Later it turned out, that this customer's demonstrative was the only person in the complete company analysis this report.

RQ2: How companies are using business value-driven decisions in Agile User Story prioritization?

The business value-creation process plays significant role for the developers' organization, not only for the customer's company. The Agile specialist's literature [3, 7] appears to share the judgment that the only value-creating deliberations that determination the development decisions are those of creating value for the customer. During this study we prepared the dependable surveillance that, more often than not, the value creation for the developers has been measured as well. We note that the theme of the accepting about business value and the RQ2 are deliberated in superior factor in [31].

RQ3: Which are the key futures to the requirement prioritizing process from customer's perspective in agile projects?

Our model is established on distributed descriptions of Agile User Stories Prioritization techniques and of case studies as show Fig. 2. We executed a research process which included the following steps:

1. Identification and analysis of data sources from available literature,
2. Initial and focused coding of the thoughts that play a role in Agile User Stories Prioritization,
3. Clustering of those perceptions,
4. Conceptual modeling, and
5. Theoretical sampling of empirical data, using the thoughts from our subsequent conceptual model.

The objective of steps 1-3 is the innovation of as numerous applicable categories as possible, including their possessions. Step 4 is around the pictorial demonstration of the categories and their relationships, and Step 5 is about 'saturating the categories'. Categories are measured 'saturated' when gathering new data no longer brings new theoretical

understandings nor discloses new belongings of the categories in the conceptual model.

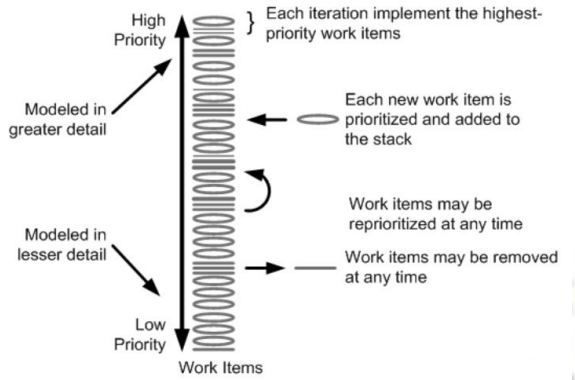

Fig. 2. Requirement prioritizing from customer's perspective.

RQ4: What are the main characteristics of the project settings for the Software requirements prioritization process?

The requirements prioritization processes differ concerning the procedures of customers´ contribution and collaboration in the process and two circumstance factors are size of the customer's organization, and size of the project in relations of resources (budget and time). In terms of size of the customer's organization are categories as follows:

1. Magnitude of customers' organization was minor and process particulars as the customer can't assign resources for contribution and in the maximum cases does not own the knowledge desirable.
2. Magnitude of customers' organization was intermediate and process particulars as Customer's collaboration is limited, don't assign resources, don't agree to customer on site or even to developer on site. The behavior changes only after little repetition where they see the welfares of the agile methodology.
3. Magnitude of customers' organization was Big Customer and process particulars as the relationship develops more strictly defined; alterations need contribution of higher-level management.

In terms of size of the project and size of resources (budget and time) are categories as follows:

1. Project resources was very limited resources in a small project and process particulars as essential minimum of functionality is absolutely vital by the end of the project. Prioritization helps to choose those requirements that are critical for supporting the key objective of the customer.
2. Project resources was bigger project where additional resources can be deliberated and Process particulars as the prioritization helps to choose the highest value requirements for the next iteration.

RQ5: What are the other project values adds from the requirements prioritization process?

The use of the prioritization in agile situation is not narrow to choosing the utmost important/valuable requirements for the forthcoming iteration. Our study exposed two other features that are very significant for the project's consequence, building the right product and incorporating new information and learning on-the-fly. Our contestants designated that in a situation of volatile or ambiguously defined requirements, the prioritization process confirms value by the change management mechanisms and by integrating learning loops in the process.

5. FUTURE WORK

Further in detail, our reflection on the gap carried us to the succeeding research questions for the future:

1. What thoughtful of developer's expectations do Agile customers essential to be mindful of and what thoughtful of customers' expectations do developers essential to be responsive of, in order to improve the value-creation process?
2. How to arrange the prioritization approaches to reproduce the certainty we detected?
3. In which project situations are we probable to detect that the expectations are not accurate? To recognize and enhanced understand those cases.

We studied current Agile User Stories Prioritization techniques and prepared a first effort to derive a model for inter-iteration prioritization decision-making from the viewpoint of the customer. We used this conceptual model to assembly concerns and solutions relevant to Agile User Stories Prioritization of requirements.

6. CONCLUSIONS

This paper recognizes and investigates the study discovered an essential gap concerning the realities of the specialists and the expectations prepared in Agile User Stories Prioritization engineering literature. We can conclude from our case study the succeeding points:

1. While an Agile software company agreements customers prioritize requirements, the requirements decision-making process can yield only when the customer's interest to create alterations along the way is in stability with the developer's attention for a supportable business
2. The existence of objective values to feed as input into the prioritization approaches is questionable; instead, what is priority appears to be a combination of subjective value-based criteria.
3. The prioritization process instantiation differs around projects at different customer companies and those differences appear to be related to project characteristics such as size of project and size of customers' organization.

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