

# A Situational Requirement Engineering Model for an Agile Process

Khush Bakhat A, Amber Sarwar A, Yasir Hafeez Motla B, and Muhammad Akhtar C

**Abstract**— Agile is a light-weight, interactive, incremental and flexible model. Due to its flexibility software industry is shifting its trends towards agile. But we have observed that certain situations it's difficult to apply agile practices. Agile faces management overhead, so most of the time, especially small and medium size enterprises have myth to apply agile practices. Due to the above mentioned problem our objective is tailoring an agile process according to the situation. We have applied grounded theory to present research problem and identified the research gaps and this reason for applying grounded theory in agile; we focus on the people and the interaction between them. We proposed a solution using various method engineering approaches, including situational method engineering and method tailoring. This study presents the requirement elicitation process optimal way so that whole development becomes easier. Our result reflects the need of situational method engineering practices to be applied in requirement elicitation especially in Small & medium sized enterprises where the cost of the project and available resources is reduced. Our proposed model, i.e. Situational based tailoring the model for agile provide a solution for stakeholders to produce quality software within cost.

**Index Terms**— Extreme programming (XP), Grounded Theory, Scrum, Situational Method Engineering (SME)

## I. INTRODUCTION

Software requirement engineering has always been the most important and difficult part in software development [1]. Requirement management [2] is the “bread and butter” of the development cycle. Requirements engineering is a process based method for defining, recognizing, modeling, linking, documenting and maintaining software requirements in software life cycle that helps to understand the problem better [3]. It serves as the basis of the software development and whole project depends on the requirement process. So for a successful and ultimate product, the requirement phase should be well elicited. There are traditional requirements, processes as well as agility. A lot of the work has been done in traditional. It focuses on project plans and documentation, in order to control the changing requirements and it prolongs over long time duration projects, but where, there is limited time we need those requirements process, which could help us to gain

better understanding of the user requirements [4]. Major issue that comes during the Requirements phase is the changing needs of the customer or user. Thus every time going back to the basic requirement stage creates havoc. Sometimes it becomes difficult to keep pace within such dynamic environment; where traditional approaches confirm that requirements can only be predicted at the start, and will remain the same until the end. So keeping track with the changing requirements could give a great set back to the business thus giving rise to the Agile software development approaches such as, Extreme programming (XP), Scrum, Crystal methods, Dynamic Software Development Method (DSDM), Lean development and Adaptive Software Development, which could efficiently improve the quality within the dynamic environment. The Goal of Agile is to cater the changing requirement evolved at any stage, within short time period. It is basically cutting down of a large piece into small pieces and then combining them at the right time. All the above mentioned approaches share a common baseline, i.e. incremental and iterative, continuous customer interaction and feedback and small releases. Most commonly used practices of Agile are Extreme programming (XP) and scrum[5]. XP is a ‘light weight methodology’ that guarantees rapidly changing requirements while keeping design simple. It offers simple design and simple practices and continuous customer feedback to handle rapid changes during requirement process. It embraces changes and frequent testing, which detects the defects on the early stage. Although it provides several advantages but it also has a limitation that it only covers, small to medium size projects. It is not a successful methodology when it comes to large size projects. Scrum is a project management process which focuses on cross functional team working at the same time in form of sprints that exposes risks, benefits and opportunities. There are two deductions: (1) Scrum results in improved quality of the software and (2) XP guarantees simple design and visibility of the project.[4] As agile methodologies [6] cannot be directly applied to large and complex projects thus we have proposed a model that focuses on combining the two approaches and produce a quality product. Our model effectively addresses the issues occurred during requirements phase and give a solution to those issues. Focusing the above mentioned deductions we have shifted some of XP's practices and scrum's requirement phase to large scale projects, incorporating tailoring[7] methods using situational method engineering approach (SME) [8] which bring rapid method engineering techniques. Brinkkemper defines the term SME as “*The discipline to*

Khush Bakhat A., Amber Sarwar A., Yasir Hafeez Motla B., and Muhammad Akhtar C., PMAS University of Arid Agriculture, University Institute of Information technology, Rawalpindi Email: khushbakhat90@gmail.com

build project specific methods called situational methods, from parts of existing methods called fragments”[9]. We have tailored the requirement phase of scrum with XP’s practices thus improving the product quality[10]. Process tailoring[11] is suitable for large sized projects but until now it has been applied to only superficial level. We have used Grounded theory as our research methodology. GT is an inductive methodology. It is the systematic generation of theory from systematic research. It is a set of

research procedures for conceptual categories. These concepts/categories are related to each other as a theoretical explanation of the action(s) that continually resolves the main concern of the participants in a substantive area. Grounded Theory can be used with either qualitative or quantitative data. Figure [1] explains that how we apply grounded theory in our proposed work that will guide us to produce a theory and can guide us to evaluate our proposed work.

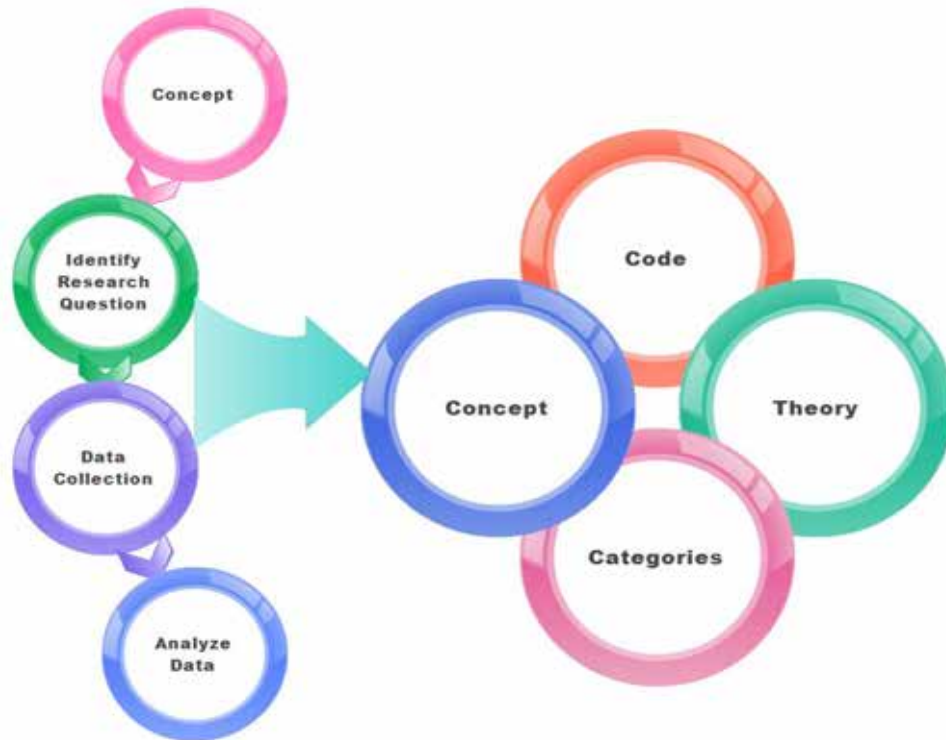


Fig. 1. Grounded Theory

Fig. 1. Explains that, first of all we chose the domain that which we select for identifying our research problem than in the next step we collect the data forms various resources. A lot of resources are available for collecting the data, including reading a historical document, by interviewing, searching databases, etc. than the researcher is required to analyze that that date and there are four steps available in grounded theory to analyze the collected data i.e. codes, concepts, categories, and final theory [12] As we have seen that it’s sometimes difficult for most of the

software companies to complete use single agile model. And also it is observed that there are various situational factors that can change from project to project, company to company or country to country. So while choosing software process for any project we need to keep in mind the factors that can affect the quality of the project. Fig. 2 presents the overview of our proposed work where we use situational method engineering SME throughout the software engineering process form user requirement in order to improve quality.



Fig. 2. Overview of the system

## II. LITERATURE REVIEW

A number of studies reveal that combining scrum and XP improves the overall product quality, but it is restricted to a small to medium size companies [13]. We have proposed a

solution to the problems encountered during the requirement phase of software development process. As we have seen that there has been a lot of research work done in requirement elicitation, requirement management, requirement change management phase. There are a lot of situational factors that can effect during the requirement

phase and also during the whole development phase [14]. Agile is an iterative incremental approach which focuses upon the quick delivery of product to customer within time and budget. Also agile methods are not the anti- methods it is possible to tailor these method according to situation of project [4]. We perform literature review that how SME [15] (Situational Based Method Engineering) is helpful in tailoring of agile methods according to situation [16]. The literature review begins by identifying different limitations regarding agile [17] and its different practices. We have also highlighted the solution to these issues. Several models have been reviewed to justify our research described here. Agile [18] is a suitable methodology, in regard of short time and changing requirements. It requires continuous customer feedback and interactive environment. It also has to cater the changing requirements of the customer, which demands great management during development. When requirements are changed, all the phases have to be managed such that changing requirements could be

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### III. RESEARCH METHODOLOGY

Fig. 3. Explains the research design of our work. We applied Grounded theory [19] for explanation of our process. Data is gathered for the research through experts' interviews, questionnaires', observations, Documents, and through historical reports. Than analysis the collected data and formulate codes, concepts, categories, theory. **Codes**: Identifying points of the data to be gathered, **Concepts**: Collections of **codes** of similar content that allows the data to be grouped, **Categories** Broad groups of similar **concepts** that are used to generate a theory, **Theory**: A collection of explanations that explain the subject of the research

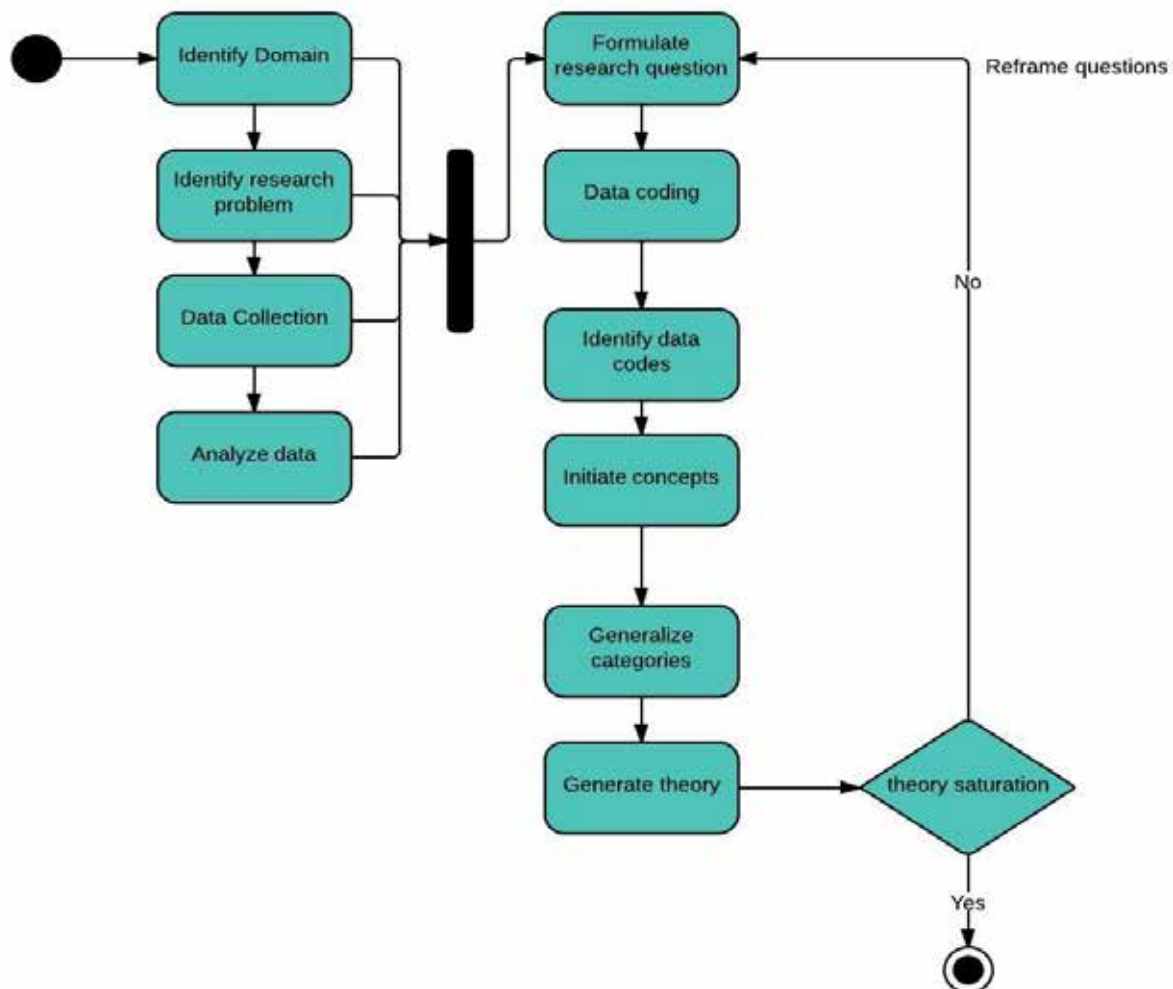


Fig. 3. Research Methodology

### IV. PROPOSED WORK

We tailor the agile process so that all the organizations that even small and medium size enterprises can easily adopt our

proposed framework. We tailor scrum and XP uses method engineering practices, i.e. situational method engineering. Requirements elicitation is done according to the situations

of the project and applied SME during the whole life cycle of the software engineering process. Which help development team to tailor processes and can made it according to their problem situation. Figure [4] shows that the client can give his requirements in the form of user stories, and can define epics and potential risks to the desire system. Software development crates the product backlog for all the user requirements and arranges these requirements according to the priority. Highest priority requirements are at the top and lowest are below as shown above. Backlog grooming takes place in the requirement change management phase. Because, as we early manage

the requirement, it helps us in further development phases the requirement repository has several rounds and we have a repository where we manage all the requirements using SME than pass these requirements to the cross functional team who communicate and collaborate with each other for further iterations. Than spikes are created for the architectural design of the system based upon which metaphor is designed. In the next step sprints are created for small releases. In the first phase of the sprint plan is created. In the second phase, we review our plan than in the third phase, we document our plan and done that document. Couch conduct sprints meetings for progress in the project

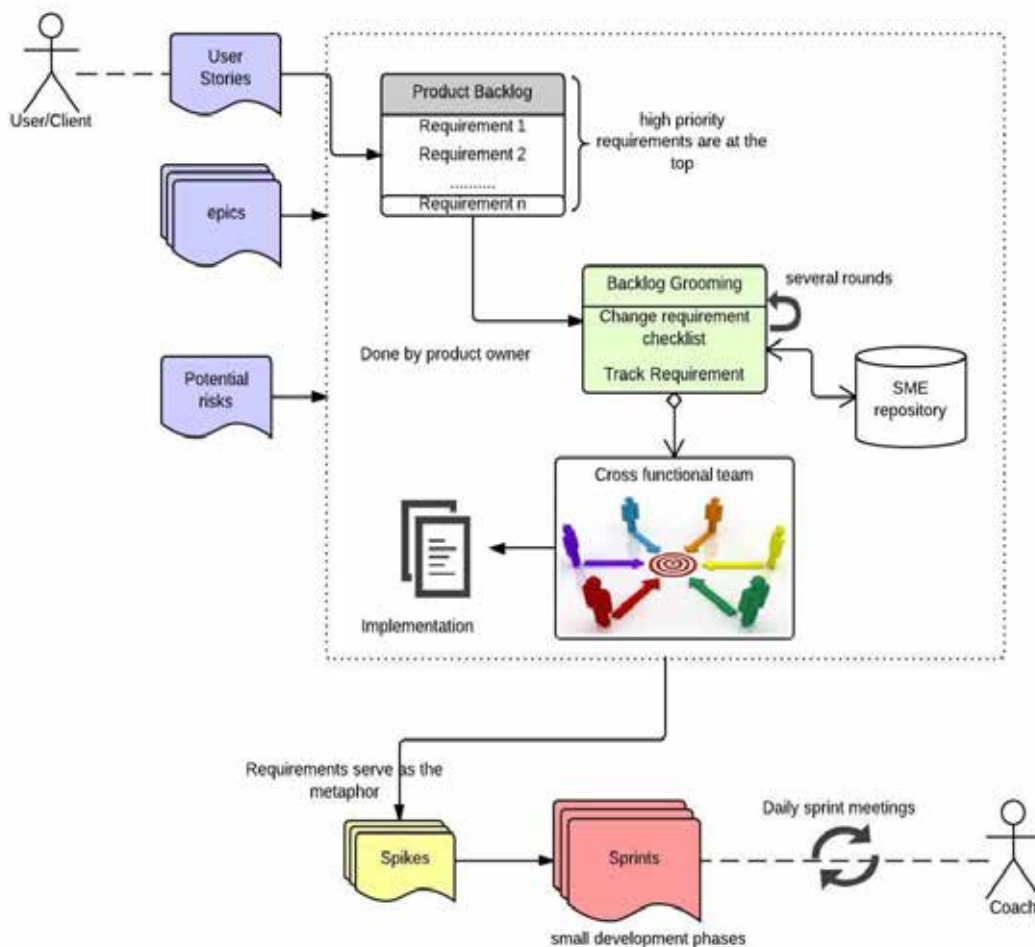


Fig. 4. Requirement elicitation phase using SME Techniques

Fig. 5. Explains each phase of the proposed system step by step **Phase 1:** In the first phase, i.e. elicitation phase, we use scrum and XP elicitation techniques to gather user stories and deal it according to the situational factors of the organization. All the user requirements are matched to our repository

**PHASE 2:** In the second phase situational Context we can check the situational context for the project where we see that according to the requirement we select the process for the project. Situational context affect during the whole system development life cycle. Situational circumstances can affect the requirement elicitation process, that's why we

are using SME techniques not only elicitation of requirements phase but also after for analysis of the requirements.

**PHASE 3:** In the third phase of our proposed model is divided into two steps, i.e. method tailoring and then we use agile practices. In method tailoring component we adopt desire system development model, retrieve that model and finally tailor it using agile practices. Next component shows that we tailor SCRUM using XP using agile modeling technique.

**PHASE 4:** In phase 4 we are able to build a situational model and we called this process as SMB "Situational

Model Building”. In that phase we are able to deal with the situational circumstances that effect throughout the system development life cycle.

**PHASE 5:** Finally, this SMB phase helps in the improvement of the product quality

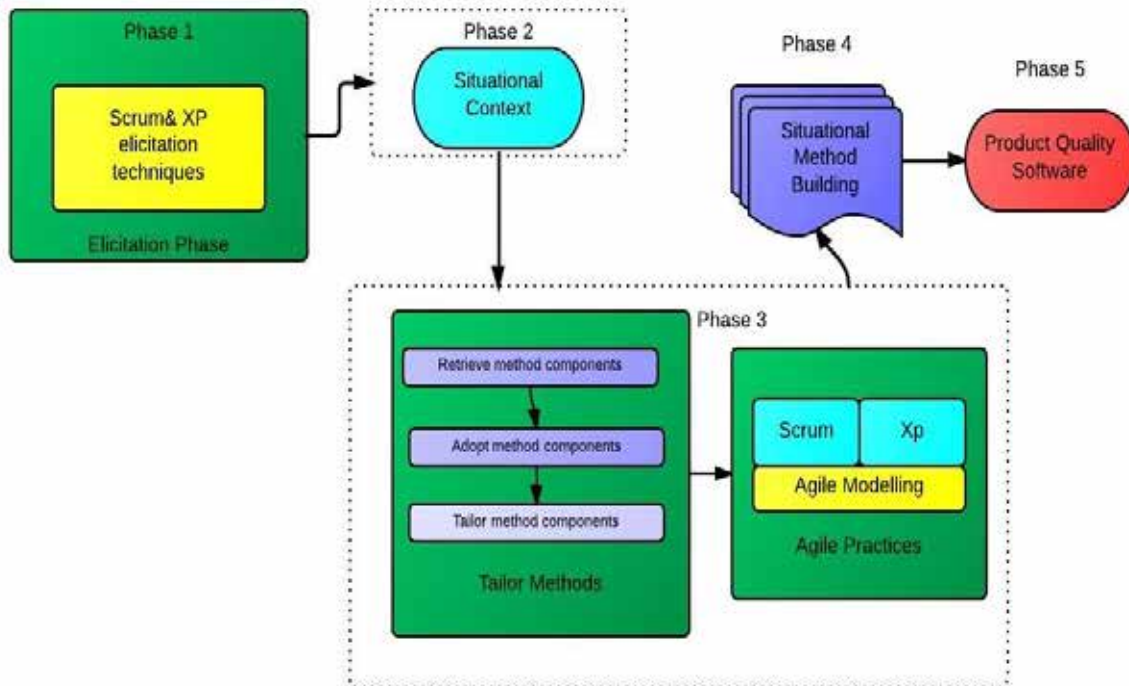


Fig. 5. Proposed Software Engineering Process

V. RESULTS AND DISCUSSION

For the generation of results we use various methods. Compare this model with prior models through and identify literature gaps from previous research through Peer Interviews, questionnaires, Industrial Survey, Expert Reviews

We can analyze all the experts’ opinion like this

- K= 1.00 it means perfect Opinion
- 0.80≤K<1.00 it means Almost Strong Opinion
- 0.60≤K<0.80 Considerable Opinion

0.40≤K<0.60 Moderate Opinion

K<0.40 Poor Opinion

“K” is constant for analysing the experts Opinion. Our process depends upon following matrices i.e. Benefits to the organization, Stakeholder satisfaction, User satisfaction after compiling the responses, we have generated its summary statistics. The average response graph is shown as below: Fig 6 shows the ease of use of tailored agile model using SME and its comparison with the Traditional agile methods, SCRUM and XP. The obtained results are shown in the above

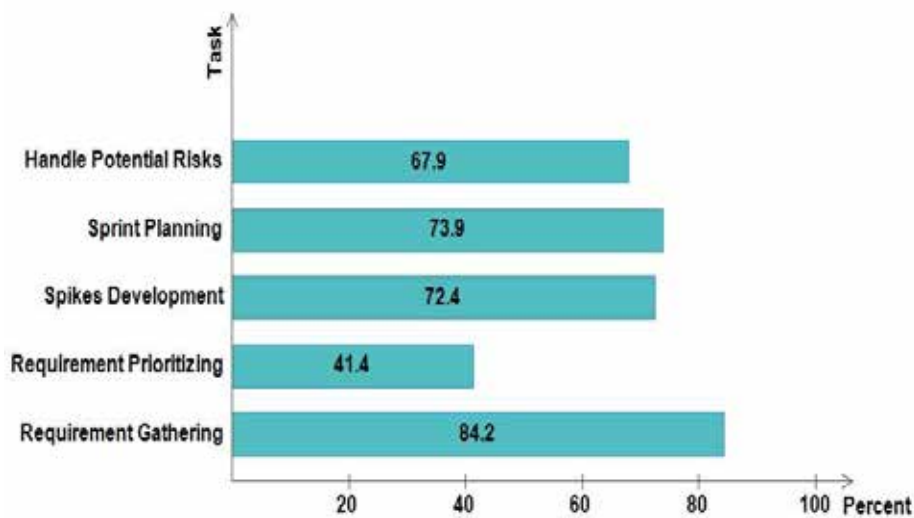


Fig. 6. Obtained Results Graphical Representation



## VI. CONCLUSION AND FUTURE WORK

Situational Method Engineering can make the development process flexible and allow us to reuse the already build parts of the software which can reduce time and can decrease costs. Tailoring allow us to cut, or enhance the model according to requirement. In the software development process situations of the project can vary from process to process, or form organization to organization. So our proposed model can provide the solution for those organizations that cannot take the benefits of agile (Small and Medium size Enterprises) due to its myth. So we tailor Scrum, which most of the small and medium size enterprises cannot adopt due to management overhead or any other issue. We provide them way adopt this model because it's a situational based model development team which can adopt according to its problem situation. In future work we will conduct further research on agile by applying method engineering practices on industrial case studies. We will conduct case studies to handle risks in situational based model in distributed environment. And after applying industrial case studies this model will use practically.

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