Factors Affecting Cost Estimation for Scrum Projects in terms of change requests

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ABSTRACT

Scrum methodology is the most useful and adopted part of the agile methodology. Many organizations are adopting Scrum from last decade to meet their business requirements. It is facilitating the software industries to develop software applications according to the user’s requirements. Scrum helps to fulfill the customer’s requirements by interaction of client and developer. Instead of this, scrum still has some challenges that influence the cost of scrum. These challenges as factors include co-ordination, team size, change request, complexity and issues in daily meeting sessions. Due to these factors mostly the cost and time exceed in scrum based projects. There are some sophisticated cost estimation techniques for scrum based projects. But all estimation techniques have some limitations that make them less useful for estimation and overcome the effectiveness of these factors in scrum. The main aim of this Paper is to provide the knowledge about key challenging factors in Scrum that cause the cost and time exceed, also briefly explain that why existing scrum cost estimation techniques are not pertinent for projects. In the last we will propose a framework as solution to manage these factors and control cost and time from exceed.
INTRODUCTION

Software Project Management is combination of different process like planning, organizing, controlling and interaction between members. Agile software methodology is widely used in software industries due to flexible and dynamic nature. In agile methodology the project is developed in different iterations and there is quick respond to changes. The agile alliance is introduced by seventeen software expert and developer’s team in 2001 and the main objectives of agile are: enhance customer and individual interaction, customer collaboration, capture requirements by rich documentation and quick respond to change. The main methods of agile are: XP, Scrum, DSDM, FDD and Crystal. But the Scrum is most important and trendy component of agile methodology in industry and research. Scrum software development process is well known for light weight process with fixed series of iterations. Scrum characteristics are: team self-determination, self organized team, quick respond to changes, flexible in nature, promote interaction between team members, work in sprints and daily meeting sessions. Scrum has been found very effective and efficient with small scale and co-located teams. Scrum basically plays vital role by helping the executives to get business results as they want. Scrum has different roles, artifacts and events. Scrum works in iterative and incremental mode. Every member in team has open access to the product metrics. Product owner communicate with the customer for requirements/ user stories [16].

Now a days Scrum become more significant due to its flexibility and rich interaction. Adaptation of Scrum is difficult to maintain as it will be complex to implement between the teams. It uses Scrum Of Scrums (SOS) meetings for collaboration and co-ordination but there is no reported evidence that these meetings are applied and coordinated [5]. Human communication and knowledge sharing are major concerns. There is no effective technique or approach that formulates to coordinate work with co-located teams and there is also no proper technique or method to organize and manage the internal dependencies, these dependencies become cause of project failure. The representatives of different software industries are facing problems and issues like co-ordination, meetings issues, team size, complexity and change request. There are only few empirical studies that focus on cost estimation techniques by which productivity and accurate estimation of cost and time can be achieved with keep in mind these factors. In this Paper we will examine the challenges faced by organizations while using Scrum. We will also discuss these factors that how these effect the scrum project’s success of completion. To
authenticate the existence of these challenges we adopt a research approach, we conduct a survey that relates the problem exist in industries in practical environment and also find these in challenges literature survey. The aim of this Paper is to provide the knowledge about key challenges about Scrum cost estimation and also briefly explain that why current scrum cost estimation techniques are not pertinent for projects. In the last we purpose a framework to estimate the cost and manage these factors.

**PROBLEM DESCRIPTION**

There are some challenges that influence the cost of scrum such as co-ordination, team size, complexity, change request and meeting session. Mostly scrum teams find issues in estimation of cost and time in Scrum projects. Due to these issues mostly industry experts avoid to use Scrum in software development. We conducted survey in different software industries to check the existence of these factors; the industries are shown below in Table.1 with descriptive information.

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Project type</th>
<th>Team size</th>
<th>Project time</th>
<th>Cost increased</th>
</tr>
</thead>
<tbody>
<tr>
<td>NETSOL Technologies (5)</td>
<td>Large-Scale</td>
<td>25 persons</td>
<td>1-2 years</td>
<td>Yes</td>
</tr>
<tr>
<td>Zameen.com</td>
<td>Large-Scale</td>
<td>8-9 persons</td>
<td>1 year</td>
<td>Yes</td>
</tr>
<tr>
<td>Shukat khanam Memorial Hospital (2)</td>
<td>Large-Scale</td>
<td>3 persons</td>
<td>5 months</td>
<td>Yes</td>
</tr>
<tr>
<td>PITB</td>
<td>Large-Scale</td>
<td>8 persons</td>
<td>8 months</td>
<td>Yes</td>
</tr>
<tr>
<td>System limited</td>
<td>Medium</td>
<td>15 persons</td>
<td>1 year</td>
<td>Yes</td>
</tr>
<tr>
<td>Arbisoft</td>
<td>Large-Scale</td>
<td>_</td>
<td>2 years</td>
<td>No</td>
</tr>
<tr>
<td>Xavor</td>
<td>Medium</td>
<td>5 persons</td>
<td>9 months</td>
<td>Yes</td>
</tr>
<tr>
<td>Consus Solutions</td>
<td>Medium</td>
<td>_</td>
<td>2 year</td>
<td>Yes</td>
</tr>
<tr>
<td>KICS</td>
<td>Medium</td>
<td>10 persons</td>
<td>7 month</td>
<td>Yes</td>
</tr>
</tbody>
</table>

The main objective of this survey is to find out the actual key challenges in the industry face by the developers and managers. We conducted a survey and filled questionnaire which was related to the problem statement. The questionnaires were filled by experts, developers, team leads and project manager of 7 different software development industries. We conducted the survey
through the interviews and email conversations. The results of survey indicate that these issues also exist in practical field work and developers face issues in development process of project and cause late delivery of projects due to inaccurate estimation. The survey results have different parameters.

Then we examined through Literature Review that there are many suggestive models and techniques for Scrum cost estimation. Analytical data is not found regarding these counter problems. These problems still exist in Literature. Fig 2 shows the journey from issues to estimation technique.
Figure 1 Factors that influence the Cost Estimation Process
After analyzing the Literature Review and industrial survey results, we have found that there is a need to device an improved approach for cost estimation for Scrum projects. We have thus formulated cost estimation technique as Paper problem. There are following reasons and challenges which effect the cost estimation of Scrum projects:

- Poor estimation (Cost & Effort estimation)
- Issues in sprint co-ordination
- Team Self-managing approach
- Working on new modules without closing existing ones (Should remove this line)
- Lacks in daily meeting sessions
- Team size issue

Different researchers and scholars worked in different time slots to provide an accurate estimation technique in scrum. But these techniques are highly dependable on previous/historical data and not a single technique provides any mechanism to overcome these factors. The project will suffer if the estimation approach to deal with these factors is not accurate and cause delay in projects. So, we narrow down our research problem by targeting the estimation approach.

**OBJECTIVE**

In this Paper, we will cover following aspects:

- Analyze key issues that influence the cost of Scrum
- Analysis of existing scrum based cost estimation techniques
- Provide Cost estimation technique considering existing Scrum limitations

**RESEARCH QUESTION**

1. What are the challenges/issues faced by the developers that influence the Cost of Scrum projects?
2. Why cost estimation techniques are not pertinent for scrum based projects?
3. How these issues will be covered through proposed estimation approach?

**PROPOSED SOLUTION/METHODOLOGY**

It is analyzed through literature review and survey that Scrum has some barriers in implementation. There is strongly need to propose an Estimation technique after examining the Literature Review and survey results that will be predictive base. This technique would help in improving the planning of development of team at initial level. The proposed estimation technique will provide assistance in effort and cost estimation. Our estimation framework starts with the review session meeting that will be held at the initial of every project. The project
manager/Scrum master briefly explain the project description to the team members (Team leaders, Developers and project manager) to find out the project cost, time and effort. In this review meeting a form is distributed to all members to collect their feedback. This feedback consists of some values that will give development experience and categorization of project type (easy/complex). In this review session, team members like project manager, developers, and team leaders will communicate to each other and to update which modules have been completed and which ones are new for the development team. Fig 3 shows the solution scenario:

![Estimation Process Diagram](image)

**Figure Estimation Process**

**Categories of Modules:**

1. **Easy:**

   The first category of the module is Easy that means there are maximum modules/sprints that have been developed by the members in other projects/applications that is similar to the current project. There is need of minor modification to meet the requirements. If the number of modules
are maximum which are already developed by developers in previous then the module will be categorize “Easy” depends on developers experience [52].

2. Complex:

The second category is the complex module that means the whole application is new for developers. They have never developed the same module in previous applications. The developers have no experience to meet the modifications of current project/sprint. The developers have to put great effort, time to accomplish the task and they need more time and cost to handle the change of request [52].

This categorization provides assistance to manager to conduct information about team members’ experience and their review about the current module estimation process. This categorization will be done by a Form that if given by manager to all the members in review session at initial stage. The form is shown in Figure 4:

![Categorization Form]

Figure 2 Categorization Form
MOTIVATIONAL WORK

<table>
<thead>
<tr>
<th>Techniques</th>
<th>Motivational Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scrum [10]</td>
<td>Review Session</td>
</tr>
<tr>
<td></td>
<td>Meeting</td>
</tr>
<tr>
<td>Planning poker,</td>
<td>Categorization</td>
</tr>
<tr>
<td>Function points [24, 36]</td>
<td></td>
</tr>
<tr>
<td>Expert Judgment [24, 52]</td>
<td>Information/opinion can get through template/form experts</td>
</tr>
</tbody>
</table>

BACKGROUND AND LITERATURE REVIEW

INTRODUCTION

This section briefly explains about the Scrum process, Artifacts, Events and Roles. The history of Scrum also described below. Existing estimation approaches will be explained in related work section. This section helps in providing basic information about Scrum Process and knowledge about existing estimation techniques.

DEFINITION OF ESTIMATION PROCESS:

Effort estimation method means the process that is used to come up with the effort estimates. The estimation process includes of historical information of previous projects. If there are no properly steps and procedures then the result can be inaccurate. Software estimation at its early stage can be determined in terms of inputs and in result of input, output is produced. Different kinds of resources are generated between the inputs and outputs. Fig 5. Shows the estimation definition given by Trendowicz and Jeffery in 2014 [23].
Input in effort and cost estimation process is the objectives of estimation process and the data that is used during estimation. This data can be categorized as qualitative and quantitative measures. This data can be collected from previous completed projects and other developmental activities. Quantity of data is not the only factor that is necessary for accuracy of estimation process. The Resources are estimation tools and individuals that are involved in estimation process. The Estimation section in the figure 5 shows that what kind of estimation procedures and methods are applied to the input. The Output represents what output will be come in result of estimation methods and techniques [23].

Cost estimation techniques and methods have been increasing over last three decades. Effort estimation is a prediction of how much time an activity will take to complete. Software cost estimation is related to how much long and how many people are involved to complete the task/project. The estimation process consists of size estimation, effort estimation, budget estimation, project schedule estimation and initial task estimation. Software estimation is done for many purposes like software planning and control, risk management, budgeting and trade-off etc.

LITERATURE REVIEW

AGILE METHODOLOGY

Agile methodology is well known as the alternative way of traditional software development processes. Agile software development is combination of software development methodologies and promotes a disciplined project management. In February 2001, a team of seventeen software developers and software specialists got together to discuss light weighted development methods and to share their experiences regarding traditional software development processes. The main goal of this meeting to find a better option. As result of this meeting “Agile Manifesto” was
introduced. The aim of introduce was to overcome the deficiencies from the efficient software development models and make the software development more easy and efficient. Agile model works with the small teams and use for the small size project development. The agile model develops any software in iterations and allow change request at any stage of project and at any iteration. It always gives priority to customer satisfaction and involve customer in software development [1, 2]. There are four major values of agile method and values are individual and interactions, responding to change, working software and customer collaboration. There are many factors that lead to the success like Modularity, Time bound, adoptions, convergent, people-oriented, iterative and collaboration [12]. There are many types of agile methods. Each model has own features. The various agile methodology are Extreme programming (XP), Scrum, Feature software development (FDD), Lean software development, Crystal clear methods, Adaptive software development, Agile unified process, Dynamic development method (DSDM) and Kanban etc. Scrum, XP (Extreme Programming), these are most known and popular agile components [13]. As study published in many papers by different researchers and practitioners that when we use Agile for small scale project with small team size it produces very efficient and good results [11].

SCRUM METHODOLOGY

In 1986, Harvard Business Review published an article entitled “The new Product Development Game” by Hirotaka Takeuchi and Ikujiro Nonaka. In this article they wrote that development organization must extend focus beyond cost, scope and time and put emphasis on speed and flexibility of product delivery. In 1993, Jeff Sutherland, Jeff Mckenna and John Scumnioales created Scrum process by adopting, implementing and documenting the model for software development. In 1995, ken Schwaber initialized the Scrum methodology that was later presented by Mike Bleedle and Ken Schwaber in a book and published by name of “Agile Software Development with Scrum” in 2001 [3, 15]. Scrum focuses rapid change of information between team members, collaboration, rate of success factor in software development and communication. Due to increase in success rate in software development, Scrum is one of the agile methodology which is widely used process. Scrum is an agile approach for developing services and products [4].

SCRUM PROCESS:
The scrum is the most important and trendy component of the agile model. The strength of Scrum basically nominated by three points that are inspection, transparency, and adaptation. Inspection helps to keep an eye on the whole process and detect deviation. Transparency helps to visualize every aspect of the process to all members involved in the development process. Adaptation provides help in adjusting the unacceptable flaws and deviation [16]. The Scrum process starts by creating a product backlog that is a prioritized list of features and other requirements needed to develop a successful product. The product owner is responsible to define the product backlog. The work itself performed by sprints that it’s called “iterations”. At the start of each sprint the team plans that which feature of product backlog is created. A plan for cost and effort estimation is also prepared in this stage. An architectural design of development plan is also designed in this stage that defines implementation, tasks and the whole procedure activities. During the iteration team performs all the task like researching, designing, constructing, coding and testing etc. At the end of iteration of separately completed features will be integrated in evolving system/product. Scrum Master and team members can plan the new iteration after the end of previous iteration for improving and adapting the changes [7].

Scrum release the functions in sequentially. The main feature of Scrum is to adapt the requirements of customers. The requirements are also called User stories. Scrum consists of 4 artifacts: product backlog, sprint backlog, release burndown chart and sprint burndown chart. Scrum master, product owner and scrum team are the roles of Scrum process. Scrum also has some events: sprint planning meeting, daily scrum meeting, sprint review and the sprint retrospective. All development activities are performed with in a sprint. In every sprint features are tested for secure quality level.

**SCRUM FRAMEWORK:**

Scrum is not a standardized process. Scrum is a framework for managing and organizing the work. The scrum framework is based on set of practices, values and principles. It also provides structure of roles, meetings, artifacts and rules. It emphasizes on decision making from real environment. Scrum is incremental and iterative framework that constructs software product in small iterations/cycles called “Sprints.” The Scrum has fixed length sprints that are typically for two weeks to 30 days. Every sprint is a time box. According to Schwaber & bleedle Scrum is divided into seven categories that are: scrum master, product backlog, Scrum teams, sprint meeting plans, daily scrum meetings, sprints and review [14, 15].Fig 6 shows example of scrum framework.
SPRINT EVENTS:

THE SPRINT

The sprint is the hearth of the Scrum. It is a time-box of two weeks to 30 days where a ready, releasable and useable product is developed. Those changes that affect the Sprint goal are not made. Sprints are used to execute the projects [14, 8].

THE SPRINT PLANNING MEETING

The sprint planning meeting is conducted by scrum master, product owner and team members. The duration of sprint planning meeting is five percentage of Sprint total length. The conversation between the team members and product owner is time-boxed. It is the responsibility of product owner to determine the prioritize the stories. The team members and product owner collaborate to estimate that how much product backlog can be developing in future sprint [8, 14].

DAILY SCRUM
In daily scrum meeting the development team arranges a 15-20 minutes time-boxed meeting every day to make a plan for next 24 hours and to synchronize tasks. Scrum meeting is held every day at same time and same place. The major purpose of daily scrum meeting to analyze the progress towards the goals and also examine that progress is trending towards executing the final task. Scrum master conducts the daily scrum meeting. Daily scrum meeting reduces the unnecessary meeting and obstacles to development, promote quick decision making, improves communication and knowledge level [8, 14, 16].

PROBLEM STATEMENT

This section briefly explains the problem with existing techniques. The issues are elaborated in the form of table. This table will give the brief information about the issues of existing techniques. This section presents the purpose and reason of topic selection for research. Research topic elaborates the factor that “Why we need to choose this topic” with the help of survey and literature review. The survey is conducted in different IT industries that deal with large-scale projects. The results of survey and existing Literature Review provide help to explain the selection of problem in an accurate manner.

FACTORS THAT INFLUENCE THE COST OF SCRUM

As scrum become more popular in the software world, new challenges are arise in scaling scrum. Scrum was designed for small co-located teams. There are lot of problems with scrum that leads the projects to being over budgeted and complex. Scrum maintains the product and sprint backlog, sprint planning, daily scrum, sprint review and sprint retrospective. Initially scrum was designed to operate projects at small level organizations [5].

- CO-ORDINATION ISSUE

Co-ordination is the combination of integration of tasks to reach at a specified goal. The co-ordination represents the dependencies of teams on each other related to functionality and code dependency. Due to lack of ineffective communication coordination issue arises. Co-ordination among co-located teams may be effect due to misunderstanding and lack of knowledge of requirements. Because the Developers and other team members in cross functional teams cannot put their best without efficient understanding regarding tasks and user requirements. The requirements’ understanding depends on the experience and skills of developers to comprehend the actual demand of application [58, 60, 61]. Scrum was designed for small scale and co-located
teams due to quick feedback to change request of customers and complete the user stories. But due to inefficient co-ordination between team members the projects become fail and this cause exceed in cost and time [10, 37, 49, 48]. In the coordination arise due to the no understanding of events during the application development in sprint. There is need to make teams for better requirements understanding and communication between them.

▪ TEAM SIZE

Team size can be categorized as team configuration. Team size refers to number of teams and communication between different co-located teams to shared understanding regarding project. The projects have multiple scrum teams for completion with the project type and nature. There are many team models that are: Isolated Scrum team, Distributed Scrum of Scrum, Fully Integrated Scrum team etc. It is analyzed that frequents meetings are required among Scrum master, product owner team and developer to ensure better and effective communication and collaboration. This category needs a lot of attention and effective communication at early stage of project [45, 47-50]. The issue related to the team size in the scrum methodology is that when the team size become increase the coordination and communication become difficult between developers. In the scrum to meet the requirements/user stories within the sprint’s deadline the team mostly increase the team size to involve one or more developers to complete the user story. The exceed in team size make difficulties to complete the project successfully. In the scrum methodology the teams are mostly self-organized that ultimately able them to do what they easy to do. This cause of cost increase in the scrum model [54, 56, 60].

▪ COMPLEXITY

Complexity in Scrum can be categorized in different terms like task complexity and story point’s complexity. All the estimation techniques ignore the developer’s skills and expertise to estimate the user stories complexities. In the scrum methodology the teams estimate the user story complexity with the help of story points. The story points are numbers in term of hours that a developer need to complete the user story. Every developer gives different story points to user story then at the end the total hours estimated for the user stories for current iteration/sprint. In the scrum methodology the issue related to estimate the user stories is that teams estimate the user stories at run time. After the 2-3 sprints delivery the team performance can be measure able. In the scrum methodology due to the self-organized, teams select and prioritize easy user stories
first to do that ultimately left the complex user stories at the end and cause of not project completion on right time [41, 42, 56, 63].

▪ MEETING SESSIONS

Scrum is mostly preferable method of agile methodology. Scrum enhances the communication at through: Sprint planning meeting, Daily sprint meeting, and Retrospective meeting. Scrum master manage the information flow between the onsite and offsite teams. Product owner organize the customer requirements/story points in the form of product backlog. These meetings are conducted through different social tools like teleconference etc. But there are some challenges that suffer the meeting schedule. It is difficult to manage a meeting time where each member form different teams can attend. Meetings likes Sprint Review some time overlap with other meetings. There are many reasons behind this like developer feel hesitation, lack of requirements knowledge etc. This influence the estimation process [10, 45, 48,53].

▪ CHANGE OF REQUEST

Change of request is a part of project development. In Scrum the development team members define the process for managing and approving the changes throughout the project. The changes at small level are directly approved by Product owner. Scrum projects warmly welcome the change of request at small level but the change of request at large level during the development process influence the cost estimation process and cause late delivery of project [43-46]. Through analysis and literature review, now we describe the challenges of Scrum in table form.

This table summarizes the challenges and issues during scaling of scrum.

PROBLEMS WITH THE EXISTING APPROACHES

In order to maintain schedule and budget of project, many estimation techniques and models have been presented. There are many existing techniques/methods that are basically divided into 2 categories:

▪ Algorithm based methods
▪ Non-algorithmic based method
NON-ALGORITHM BASED METHODS:

PLANNING POKER

According to this technique team members discuss about cost and effort estimation. Each member have different requirements regarding estimation, all team members participate in discussion and exchange their requirements regarding estimation process. After a brief discussion session, team members finalized the estimation process and requirements by comparing with each member requirements. This technique is useful to ensure the team member interaction.

This technique has less empirical evidence regarding accuracy and less applicable in software industry. This technique is not predictive base.

Now we describe the features and issues of existing estimation methods in table forms. This description is useful for obtaining summarized and appropriate information about existing estimation techniques at a glance. Table 6 shows a comparison of above mentioned techniques for estimation [17, 21, 23, 24, 31, 32 ].

Issues:

There are several challenges of planning poker:

- Planning poker is less accurate when there is lack of previous experience for same projects.
- Anchoring effect is another issue of planning poker which means build own opinion by using initial piece of information and skills as a base. It’s like an idea that comes up from initial discussion and have deep impact and influence on the remaining part of discussion.
- Domination is also another issue of planning poker. In meeting session, when a most experienced member select a card with a random number of user stories, test objects, specifications, requirements, test cases or bugs etc. then the remaining all members with less experience follow same pattern of picking the card. This influence the results.
- Like expert estimation planning poker also required involvement of highly extensive vs. killed and experienced persons who represents variety of viewpoints.
- In planning poker like expert judgment, the judgment may be biased by irrelevant and misleading information and planning poker do not provide as such method or procedure that can be reused.
WIDEBAND DELPHI

This technique puts focus on interaction between team members. The whole task is structured into breakdown framework where each member is assigned a task. The team members perform their relevant task to estimation purpose. It includes expert’s opinions. Quality aspect is also considerable in this technique. This technique is useful for agile based projects where interaction and communication between team members is essential principle for development [23, 24].

Issues:

- Wideband Delphi also required extensive skilled and experience person and opinions can be biased by providing irrelevant information.
- Mostly experts fail to provide objective and quantitative information regarding project effort dependencies like what kind of project characteristics may affect the scope and which characteristics affect the extent.
- False confidence is developed due to biased judgments. The judgments contain irrelevant data may develop the false confidence of estimator like to complete the story point in an estimated time span.
- It is difficult to repeat the technique again and again with different groups. The wideband Delphi technique does not provide as such specific model for estimation that can be used again and again for different projects.

EXPERT JUDGEMENT METHOD

This approach involves discussion with experts or group of experts to use their experience and their domain knowledge about the project to reach at the estimation. This approach is widely used by companies. Delphi is introduced to satisfy broad communication bandwidth. The Delphi technique has been successfully used in estimation techniques. The steps of estimation procedure are given below [17, 23, 28, 34]:

- Coordinator/ project manager arrange a meeting of experts
- Experts discuss issues and elaborate the requirements
- Experts anonymously fill out estimation form
- Coordinator/ Project Manager prepares a summary on an iteration form about estimation
- Above steps iteratively repeated to reach at appropriate round.
Issues:

- Highly and extensively dependency on experts opinion and experience. So needed most experienced and skilled person for judgment and this enhance the cost.

- This technique sometimes dependent of measurement data, this data support experts to estimate the project effort. But this messy data and information mislead the experts due to data deficits like incompleteness and inconsistency and lead the project to wrong estimation. This data must be given after several analyzed techniques.

- This technique is not predictive base, because mostly human judgments are not repeatable and reusable. Here the repeatable and reusable mean that previous judgments for similar project cannot be consider for current project. Because these estimations are human based judgment and can be biased by misleading and irrelevant information, usually requirements are remain incomplete.

ALGORITHM BASED METHODS:

STORY POINT

Story point basically is used to estimate the size. Story point is the unit of software size and intuitive combination of complexity and inherit risk development effort. It is assigned as Fibonacci number sequence. The user stories are measured as story points. A story point can be divided in smaller, easier and estimate blocks.

Issues:

- Mostly estimators face difficulties to choose story points in case of multiple user stories. Selection of particular user story impacts the estimation process. There is no specific tool or procedure for selection/ priority of user stories. The selection method of story points totally based on estimator. If the estimator have sufficient knowledge and skills then the project will not suffer but in case of lack of project understanding the project will suffer.

- Desire to achieve more and more, sometimes team members inflate the story points. Team under pressure to achieve more story points mostly fall in the illusion of higher velocity. This illusion creates low quality of work.

- Team may not comfortable in early phase of story point estimation due to different agile methodology in team and if there is lack of coordination then the project will suffer.

[18, 19, 24, 30, 32].
USE CASE POINT

This method is best suited for object-oriented software development. In this method use cases and number of actors are used to calculate the Unadjusted Use Case Point. Like function points it also used environmental adjustment and technical complexity to find adjusted UCP. As in case of Agile it counts transactions as per use case. The resulting value very close to actual effort [18, 23, 32, 35].

Issues:

- Use case point do not capture the non-functional story points like portability, maintainability, performance etc. properly.
- UCP can only be used when the user stories are written in the form of use-cases, uniformly structured and with the goal. These user stories must contain detailed information about functionality. If there is no detailed information then the resulting UCP may not be accurate.
- UCP is well useful for initial estimation for whole project but it is not useful when there is iteration to iteration work. Like if the team completed the first 2 sprints and working on next sprint and then a change of request is requested by user then it impacts on overall project results.

• VELOCITY

Working capability of team members in each iteration is called Velocity. Velocity is a unit to calculate the team progress rate. Story points are used as metrics of velocity. Effort estimation basically consist of story size, velocity and complexity. Velocity refers to help the team to polish their estimates of a project. It enables the overtime calculation and release planning [24, 28, 29, 30].

➢ V= Story point completed in one iteration / Story point in one user story.

There are two types of Velocity measurement (1) Actual Velocity (2) Expected Velocity.

1. Actual Velocity:

   In the actual velocity is the real out of the team estimated after delivery of some sprints. The team output determined when some user stories done by developers [62, 63, 64]. The total actual velocity can be measure:

   \[
   \text{Actual Velocity} = (V_a).
   \]

   \[
   (V_a) = \sum \text{Achieved Feature Story Points} / \text{Sprint}
   \]

2. Expected Velocity
The Expected Velocity is the velocity that expected from the team as output before the delivery of any user story or sprint [62, 63, 64].

SLOC

Estimate/ size is one of the most important element of the software development. It is the key marker to tell about the cost, effort and time of the venture. Size of the undertaking is likewise the base unit to determine different measurements for the project. According to the Boehm perspective about the cost estimation of project, size of the project is fundamental part for the estimation models. So the simple approach to measure the size of the project is source line of code (SLOC). SLOC is conventional, old and most popular measure the size of the project. The source line of code is not the sole supporter to estimate the cost, effort and time of the project. It just serves as the input to estimate the cost, effort and time of the project. SLOC contribution in estimation of the project is very important because the SLOC tells about the size of the project and effort required for the project. The IEEE standards also provide the definitions and attributes for the software productivity metrics [20-26, 39, 40].

Issues:

- SLOC does not effectively correlated with the software functionalities like a program with less size code may contain more functionalities as compare to large size because some developers developed the same functionalities of large size code with small size code.

- It was a tradition of one to one corresponding between instruction and physical lines that was broken due to new emergence in technologies like high level programming. Functionality must be same on two different platforms. This thing badly affect the measuring metric SLOC.

Table 3 FEATURES AND ISSUES OF ESIXTING METHODS

<table>
<thead>
<tr>
<th>Method</th>
<th>Type</th>
<th>Features</th>
<th>Issues</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poker planning</td>
<td>Non-algorithmic</td>
<td>✓ Useful for enhancing team members interaction ✓ Not required historical data</td>
<td>✓ Less empirical evidence regarding accuracy ✓ Less applicable ✓ No reusability ✓ Extensive skilled people required</td>
<td>[17, 21, 23, 24, 31, 32]</td>
</tr>
<tr>
<td>Method</td>
<td>Algorithmic</td>
<td>Pros</td>
<td>Cons</td>
<td>References</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-------------</td>
<td>----------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------</td>
<td>---------------------</td>
</tr>
</tbody>
</table>
| Wide band Delphi              | Non-algorithmic | ✓ No required historical data/particular for its input  
✓ Intuitive and easy to apply | ✓ Biased by providing misleading data  
✓ Need repetition at each estimation  
✓ False confidence developed  
✓ Experts can be biased  
✓ Fail to provide objective and quantitative analysis | [23, 24, 68, 69, 70, 71] |
| Expert judgment               | Non-algorithmic | ✓ Rapid prediction | ✓ Highly dependency on expert’s opinion and experience  
✓ Requirements remain incomplete mostly  
✓ Biased by providing irrelevant data  
✓ Extensive skilled and experienced people required  
✓ Cost increased | [17, 23, 28, 34] |
| Use-case Points               | Algorithmic | ✓ Best suited for object-oriented development | ✓ Need detailed data  
✓ Not useful for iteration work | [18, 23, 32, 35, 67] |
| SLOC                          | Algorithmic | ✓ Serves the input to estimate the cost, time | ✓ Difficult to estimate exact line of code  
✓ Not effectively correlated with functionalities  
✓ New emergence in technologies like high level programming | [20, 21, 22, 23, 25, 26] |
| Story Point                   | Algorithmic | ✓ Foster collaboration  
✓ Easy, intuitive and take less time | ✓ Illusion of higher velocity  
✓ Quality is sacrificed  
✓ Teams may inflate story points | [18, 19, 20, 23, 24, 27, 30, 32, 66] |
It is also analyzed by literature and survey results that developer skills are also neglected in estimation process. Every member of Agile Scrum team has different skills, different way of thinking and level of experience [46]. Mostly estimation work is done by senior resources that are against the teamwork and Scrum but IT industries are working like that. Generally, there are 2 situations:

1) If a certain task is given to a senior and experienced developer that will take 2 days
2) But if the same task is given to the junior and less-experienced person that will take 3-4 days.

This thing cause sprint delay and project does not meet the timeline span.

**RESEARCH METHODOLOGY**

We adopted two strategies for research methodology one is literature review and the second one is the survey that we conducted from the software industries that using scrum methodology for software development. The adopted methodology is shown in the figure.10 below.

**SCOPE**

The scope of the problem statement is to define factors that influence the cost in the scrum methodology. The preliminary studies only highlight these factors and do not find any solution related to overcome these factors and control the cost to increase.

**OBJECTIVES**

The main objective of the Paper is to propose an estimation technique to control the influence of factors on cost and time increase.

**Data Collection**

The selected data collection method was semi-structured survey. We conducted a survey and filled the questionnaire in those industries where Scrum is implemented in most projects. The questionnaires were filled by experts, developers, and representatives of 7 different software development industries. That enables the developers, experts to touch upon the different issues as needed as come up with new aspects and themes. In order to get in-depth information, clarify our understandings and respondents full cooperation, we conducted a survey through interviews and email conversations. We created a quantitative and qualitative analysis with the help of
completed questionnaires that were used to answer the research question. When questionnaire was made, the research process was going through some steps:

1) Schedule the time for interview
2) Conduct the survey
3) Rewrite the interview by analyzing the grouping statements

In interviews
1) Firstly we explain the motive behind this research to the interviewers (candidates),
2) We gave them the questionnaire and then started discussing the answers. The main objective of this survey is to find out the actual key challenges in the industry face by the developers and managers.

**Analysis Procedure**

We analyzed the results of the interviews purely quantitatively. The data to be analyzed was going to be quantitative textual data. Because there was restraint of time, we decided that minimum one person of each role must be interviewed. In other words all roles must be covered in different teams where multiple of persons are working for a single role. We categorized the answers into a table like “team size”, “complexity”, “coordination” etc. the text and figures was placed to the relevant categories. The segments that are not related to the research question are dismissed. We further extracted the results for each research question and refine the answers in the form of the graph.

**Validity Procedure**

Our main purpose was to build and use the interview guideline to support the validity of the results. Firstly we select the study areas so make sure to avoid any interference between them. At initial, we stated the purpose to the interviewees with the intention to give fair and honest answers. The questionnaire and factors that influence the cost in scrum are mentioned below. The Reference Column is highlighting that the factors and survey questions exist in these papers. The main objective of this research is to highlight the issues of Scrum that leads to projects to be over budgeted and complex. The research goal is to analyze the Scrum framework to explore the issues and variations regarding estimation process. For this sake we designed a questionnaire that covers some major issues belong to estimation process. We ended this section by exploring the issues through survey and Literate Review. The questionnaire holds the questions like:
Firstly, the literature review focused on the Scrum framework, metrics, existing Cost Estimation models and Scrum Cost estimation issues. Different search strings were used to gather data regarding Scrum development, factors that influence the Scrum Cost, Cost estimation techniques etc. Table 8 shows the research strings for literature review. These strings are search by Google Scholar, Elsevier, IEEE, Research Gate and Semantic Scholars. We found cost estimation papers frequently.
Second, the research in this Paper was conducted through survey using a questionnaire as the data data gathering method. The scope of this research is to develop a new estimation technique. In order to get in-depth information, clarify our understandings and respondents full cooperation, we conducted a survey through interviews and email conversations. We selected different organizations like Netsol, Zameen.pk, PITB and many other for survey. There are 20 respondents from these software development organizations. We examined through survey results that there are some challenges like issues in daily meeting session, communication gap, and time zone exists in industries. The study concluded that the more issue while using the scrum methodology in the software industries is change of request with 80% that come from client side, after it the scrum implementation in the industry is biggest challenge due to the non-cooperative behavior of the software developers or teams. The teams in the software industries are still focusing and following the traditional way of development. The other major challenges in the
software industries while adopting scrum methodology are cost and time increase from the project’s actual values. These existence rates in the software industries are 70-75 %. The remaining challenges are self-organized team, co-ordination and daily meeting session as 60%, 63% and 55%. The developers become agitate form the daily meeting session. We study conclude that most of the developers do not participate in the scrum daily meetings. Then teams have no accurate update of the project and at the end the whole project become failing. The self-organized team mechanism also promotes the political policies among the teams as done in the planning poker. In the self-organized team mechanism the developers dominate their one team member and follow its inputs instead he/she is giving accurate inputs or not. This issue also effects the team’s coordination, when the project is distributed and all team dependent on their inputs.

After analyzing the survey results and literature review the research question was found. The aim of survey and literature review to look for problems in software industries and research papers that is visible through results.

**OBJECTIVE**

**Survey Question:**

**SQ1:** Do team members generally communicate without confusion?

**SQ2:** Is there a face-to-face communication gap between persons at different sites?

**SQ3:** Do you face issues/challenges while conducting daily meeting sessions? Please explain/highlight

**SQ4:** Does the team member understand the project vision and goals and do they truly believe that they can solve any problem to achieve any goals as a team?

**SQ5:** Is the scrum team engaged in the decision-making process (rather than making or succumbing to decision from others)?

**SQ6:** Quality control and frequent deliveries are made?

**SQ7:** Does the quality of the product being developed can be assessed?

**SQ8:** Current project time and size in which using scrum methodology?

**SQ9:** Is your team self-organizing, rather than functioning in command and control (top-down organization)?

**SQ10:** While using Agile Scrum methodology for software development frequent change requests come from client side?

**SQ11:** Does the cost of the projected increase after the change request come from the client side?

**SQ12:** Does the time of the project increase after the change request come from the client side?
<table>
<thead>
<tr>
<th>QUESTION</th>
<th>Key CHALLENGES</th>
<th>REFERENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Do team members generally communicate without confusion?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Is there a face-to-face communication gap between persons at different sites?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SQ</td>
<td>Co-ordination</td>
<td>1, 2, 3, 4, 5, 6</td>
</tr>
<tr>
<td>• Do you face issues/challenges while conducting daily meeting sessions? Please explain/highlight</td>
<td>Meeting Sessions</td>
<td>7, 8, 9</td>
</tr>
<tr>
<td>SQ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Does the team member understand the project vision and goals and do they truly believe that they can solve any problem to achieve any goals as a team?</td>
<td>Complexity</td>
<td>10, 11, 12, 13, 14</td>
</tr>
<tr>
<td>• Is the scrum team engaged in the decision-making process (rather than making or succumbing to decision from others)?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Quality control and frequent deliveries are made?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Does the quality of the product being developed can be assessed?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SQ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Current project time and size in which using scrum methodology?</td>
<td>Team size</td>
<td>15, 16, 17, 18, 19</td>
</tr>
<tr>
<td>• Is your team self-organizing, rather than functioning in command and control (top-down organization)?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SQ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• While using Agile Scrum methodology for software development frequent change requests come from client side?</td>
<td>Change of Request</td>
<td>20, 21, 22, 23, 24, 36</td>
</tr>
<tr>
<td>• Does the cost of the projected increase after the change request come from the client side?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Does the time of the project increase after the change request come from the client side?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Methodology

This section provides explanation on the research method that was selected to produce the results for this study. In this section includes the sampling design, research instrument and data analysis procedures that were carried out in this study. Survey questionnaire method would also produce a more consistent range of response from its participant thus making it easier to accumulate and analyze the data.

Population

Six different Software houses in Pakistan were selected for data collection in this study. The different software houses targeted in size and population, who develops different software’s houses. Sample size selected through G power and 30 sample size selected at the medium level.

Sample

Sample was selected from the different software houses the purposes of this study, 30 questionnaires were distributed through online ULR. Only 30 questionnaires were returned, resulting in 100 percent response rate. Sample for research was 15 male and 15 female were selected. Six software houses and 20 to 65 age range participants were included in this study and Below 20 and above 65 years age ranges also were not selected and other software houses were excluded.

Measures

The instrument consisted of a self-administered survey, which included several background information questions as well as a series of Likert-type items. The Likert-type items were used to measure the Factors Effecting Cost Estimation for Scrum Projects (12 items). In
under the questionnaire measure some independent and dependent factors. To measure the depended variable and independent variables regarding cost time size and manager role etc the demographic questions were designed to ask at a very start of the questionnaire.

<table>
<thead>
<tr>
<th>Dependent variables</th>
<th>Independent variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>COST</td>
<td>Communication</td>
</tr>
<tr>
<td></td>
<td>Manager Role</td>
</tr>
<tr>
<td>Time</td>
<td>Change of Request</td>
</tr>
<tr>
<td></td>
<td>Module / sprint formation</td>
</tr>
<tr>
<td>Requirement understanding</td>
<td>language</td>
</tr>
<tr>
<td></td>
<td>experience</td>
</tr>
<tr>
<td>User stories Handling</td>
<td>Developers participation</td>
</tr>
<tr>
<td></td>
<td>Self made team</td>
</tr>
</tbody>
</table>

Table # 1: Factors study under the software houses

**Cronbach’s Alpha Reliability**

According to Varma (2006), a Cronbach’s alpha value ranges from 0 to 1.00 and a value of 0.7 to 0.8 and above indicate high internal consistency whereas values lower than 0.7 indicate an unreliable scale. The result of the reliability test for this study is shown in the tables below.

<table>
<thead>
<tr>
<th>Scale Name</th>
<th>Item Number</th>
<th>Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factors effecting cost estimation questionnaire</td>
<td>12</td>
<td>.77</td>
</tr>
</tbody>
</table>

Table # 2: Alpha showed reliability of Factors effecting cost estimation questionnaire.

**Validity of Measurement scale**

Validity of activity is said to the degree to that the tool produces the correct results. Validity check is applied to visualize the accuracy of form. Eigen values, content validity, and item loading ranges are taken from previous analysis. The same construct validity techniques are applied on our collected information. Positive Eigen values are thought of pretty much as good. All freelance variables fall in positive criteria. Variety of item loading vary >=0.4 and <=0.6 are thought of to be sensible. Eigen values, things loading vary are given within the following table.

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Eigen Value</th>
<th>Depended Variables</th>
<th>Eigen Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication</td>
<td>.615</td>
<td>Cost</td>
<td>.356</td>
</tr>
<tr>
<td>Manager Role</td>
<td>.874</td>
<td>Time</td>
<td>.727</td>
</tr>
<tr>
<td>Change of Request</td>
<td>.473</td>
<td>Requirement understanding</td>
<td>.945</td>
</tr>
</tbody>
</table>
Module / sprint formation  .450  Users stories handling  .953
Team based issue  .299
Language  .945
experience  .945
Developers participation  .953
Self made team  .781

<table>
<thead>
<tr>
<th>Table #2.1: Eigen values of variables</th>
</tr>
</thead>
</table>

Figure#1: showed plot scree validity of the questionnaire

Criterion validity is applied to ascertain the link of the variable quantity with all depended variables. In our thesis the structure performance may be a variable quantity and it shows positive relations with all the opposite freelance variables. Talus plot of elbow shapes are thought of to be acceptable. Following below grid shows the talus plots of all variables.

Data Collection Procedure

The Questionnaire instrument completed by participants was made available through an easy to remember URL (Online survey.com), which pointed to the survey hosted by Google
form, an online survey service. For this study nonrandom sampling techniques selected for respondent’s a Google form is shared via different social media websites who were running the software houses, or working as a developer in some private and government software houses. A total of 12 questions were asked from respondents for this study. The questionnaire is consisting of different sub variables. In the very first part respondent were asked general demographic questions about their organization. Twelve questions consist on the factors effecting cost estimation.

**Data Analysis**

All of the data have been entered into and analyzed by the Statistical Package for the Social Science (SPSS) for Windows, version 20.0. Prior to statistical analyses, data cleaning and handling of missing values were performed. Frequency distributions of all the variables were checked for outliers, missing data, and typing errors. Normal distributions of the dependent and independent variables were assessed. Summary statistics, including the computation of means, standard deviations, frequency counts, and percentages of all data, were performed. The Chronbach’s alpha coefficients for internal consistency reliability and validity of the questionnaire short form were evaluated.

Mean scores and standard deviations were computed for all factors. Pearson r correlation has been used to answer research question three in this study. Pearson r correlation has been used to examine significant relationships between the continuous variables of all factors. The data have been evaluated to identify if statistical assumptions are met. An alpha level of confidence was at .001 for statistic tests. All data had been entered into SPSS 20.0 for Windows software for analyses. Descriptive statistics and measures of central tendency for all variables, and internal consistency reliability coefficients and means and standard deviations for the two study instruments were computed where appropriate. Alpha was set at .001 level of confidence. In order to investigate the hypotheses and research question, regression analysis and correlation was used to estimate the unique relationship between each of the questionnaire and outcome variables in this study. Furthermore, to assess where there were significant differences amongst the through t-test.
Testing of Hypotheses and Presentation of Results

The content of this section comprises of two sections which are demographic profile of respondent and inferential statistics. The Respondent’s characteristic such as gender, age, designation, software house and experience describe in demographic profile. For Inferential Statistic, Independent T-Test, Pearson Correlation Analysis and Regression were applied to test on the hypotheses of the study.

**Descriptive Statistics about the Variables**

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>30</td>
<td>1.00</td>
<td>2.00</td>
<td>1.5000</td>
<td>.5085</td>
<td>.000</td>
</tr>
<tr>
<td>Age</td>
<td>30</td>
<td>1.00</td>
<td>4.00</td>
<td>1.9667</td>
<td>.8899</td>
<td>.697</td>
</tr>
<tr>
<td>Experience</td>
<td>30</td>
<td>1.00</td>
<td>4.00</td>
<td>1.6333</td>
<td>.9643</td>
<td>1.324</td>
</tr>
<tr>
<td>Designation</td>
<td>30</td>
<td>1.00</td>
<td>4.00</td>
<td>1.9333</td>
<td>1.0148</td>
<td>.777</td>
</tr>
<tr>
<td>COST</td>
<td>30</td>
<td>5.00</td>
<td>20.00</td>
<td>15.6000</td>
<td>3.3487</td>
<td>-1.710</td>
</tr>
<tr>
<td>Time</td>
<td>30</td>
<td>5.00</td>
<td>15.00</td>
<td>10.9333</td>
<td>2.5452</td>
<td>.120</td>
</tr>
<tr>
<td>Requirement understanding</td>
<td>30</td>
<td>1.00</td>
<td>4.00</td>
<td>2.1333</td>
<td>.9371</td>
<td>.258</td>
</tr>
<tr>
<td>User stories Handling</td>
<td>30</td>
<td>2.00</td>
<td>5.00</td>
<td>2.6333</td>
<td>.76489</td>
<td>1.250</td>
</tr>
<tr>
<td>Communication</td>
<td>30</td>
<td>1.00</td>
<td>3.00</td>
<td>1.7333</td>
<td>.82768</td>
<td>.551</td>
</tr>
<tr>
<td>Manger role</td>
<td>30</td>
<td>1.00</td>
<td>4.00</td>
<td>2.4000</td>
<td>.85501</td>
<td>.156</td>
</tr>
<tr>
<td>Change of request</td>
<td>30</td>
<td>4.00</td>
<td>8.00</td>
<td>6.3667</td>
<td>1.12903</td>
<td>-.337</td>
</tr>
<tr>
<td>Module/Sprint Formation</td>
<td>30</td>
<td>1.00</td>
<td>5.00</td>
<td>2.1000</td>
<td>1.02889</td>
<td>.806</td>
</tr>
<tr>
<td>Team base issues</td>
<td>30</td>
<td>7.00</td>
<td>15.00</td>
<td>10.5667</td>
<td>2.50080</td>
<td>.419</td>
</tr>
<tr>
<td>languages</td>
<td>30</td>
<td>1.00</td>
<td>4.00</td>
<td>2.1333</td>
<td>.93710</td>
<td>.258</td>
</tr>
<tr>
<td>Experience</td>
<td>30</td>
<td>1.00</td>
<td>4.00</td>
<td>2.1333</td>
<td>.93710</td>
<td>.258</td>
</tr>
<tr>
<td>Developers participation</td>
<td>30</td>
<td>2.00</td>
<td>5.00</td>
<td>2.6333</td>
<td>.76489</td>
<td>1.250</td>
</tr>
<tr>
<td>Self made team</td>
<td>30</td>
<td>2.00</td>
<td>10.00</td>
<td>6.2000</td>
<td>2.07448</td>
<td>.111</td>
</tr>
<tr>
<td>Factors Effecting Cost Estimation</td>
<td>30</td>
<td>2.00</td>
<td>3.00</td>
<td>2.0667</td>
<td>.25371</td>
<td>3.660</td>
</tr>
</tbody>
</table>

*Table3: showed mean, SD*

**Note: A 5-point Likert scale ranged from 1= strongly agree, to 5 = strongly disagree.**

Descriptive statistics Table (1) outlines the mean scores and standard deviations of each of the all variables under this study. The mean and SD of the demographic variables is the gender (M=1.500, SD=5085), age (M=1.9667, SD=.8899), experience (M=16.33, SD=9643), designation (M=1.9333, SD=1.0148). The mean and SD scores of the independent variables is time (M=10.93, SD=2.545), cost (M=15.60, SD=3.348), requirement understanding (M=2.133, SD=.9371) and users stories handling (M=2.633, SD=.7648).

The mean and SD score of the independent variables are communication (M=1.733, SD=.8276), manger role (M=2.4000, SD=.8550), change of request (M=6.366, SD=1.129), module/sprint formation (M=2.100, SD=1.028), time base issues (M=10.56, SD=2.500), language (M=2.133, SD=.9371), experience (M=2.133, SD=.9371), developer participation (M=2.633, SD=.7648),self made team (M=6.200, SD=2.074) and factors effecting cost estimation (M=2.0667, SD=.2537).
Based on Figures 2, the numbers of participant’s 50% female and 50% male were responded in the questionnaire. The age factor 70% lead to (0-5) years experience and 30% age factor lead to (5-15) year’s experience. Overall six different software houses included in the research and software houses have a different percentage showed above pie chart. In this study 43% developer, 30% programmer, 16.67% team leader and 10% other designation post respondents record their response.
Hypothesis testing

This section commences with a detailed analysis of data that provides an insight into the findings of the study, accompanied by numerical and graphical representations of the data and interpretation of results. The presentation of detailed analysis and findings, which were extracted from questionnaires used for collect data discussed in this section. The hypotheses for this study were evaluated using inferential statistics in the form of the Pearson correlation analysis. Multiple regression analysis was used to ascertain the strongest relationship between variables that were measured.

Findings of the study

Co relational study between transformational leadership styles, transactional leadership style and the employee satisfaction in IT service department. The findings for each hypothesis are explained below.

H01: There would be significant relationship between all variables cost, communication and manager role.
H02: There would be significant relationship between all variables time, change of request, module/sprint formation, and team based issues.
H03: There would be significant relationship between all variables requirement understanding, language, and experience.
H04: There would be significant relationship between all variables user stories handling, developer’s participation and self made team.

i. Using correlation

<table>
<thead>
<tr>
<th>Variables</th>
<th>Pearson correlation</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>.310</td>
<td>Significant correlation</td>
</tr>
<tr>
<td>Time</td>
<td>-.254</td>
<td>Negative correlation</td>
</tr>
<tr>
<td>Requirement understanding</td>
<td>.127</td>
<td>Significant correlation</td>
</tr>
<tr>
<td>User stories Handling</td>
<td>.008</td>
<td>Weak correlation</td>
</tr>
<tr>
<td>Communication</td>
<td>-.214</td>
<td>Negative correlation</td>
</tr>
<tr>
<td>Manger role</td>
<td>.022</td>
<td>Signification correlation</td>
</tr>
<tr>
<td>Change of request</td>
<td>.104</td>
<td>Weak correlation</td>
</tr>
<tr>
<td>Module/Sprint Formation</td>
<td>.102</td>
<td>Weak correlation</td>
</tr>
<tr>
<td>Team base issues</td>
<td>.016</td>
<td>Weak correlation</td>
</tr>
<tr>
<td>languages</td>
<td>.127</td>
<td>Weak correlation</td>
</tr>
<tr>
<td>Experience</td>
<td>.127</td>
<td>Weak correlation</td>
</tr>
<tr>
<td>Developers participation</td>
<td>.008</td>
<td>Weak correlation</td>
</tr>
<tr>
<td>Self made team</td>
<td>-.236</td>
<td>Negative correlation</td>
</tr>
</tbody>
</table>

**Correlation is significant at the 0.01 level (1-tailed). * Correlation is significant at the 0.05 level (1-tailed).
Table #4: factors of the questionnaire

In the above table the Spearman rho correlation of nonparametric tests was also used to support these finding. There will be significance and negative relationship between all the dependent and independent variables. The Pearson r correlation was computed to examine significant relationships between the dependent variables and all the independent variables of the instrument. The correlation coefficients were negatively significant in some variables showed in the above table. Most of the variables have weak correlation between the computed variables. So H01, H02 and H03 accepted because there would be founded correlation between all the variables.

ii. Using of simple mean t-test

H05: There would be no gender difference among Factors Effecting Cost Estimation for Scrum Projects.

<table>
<thead>
<tr>
<th>Factors Effecting Cost Estimation</th>
<th>Gender</th>
<th>Mean</th>
<th>N</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>2.0667</td>
<td>15</td>
<td></td>
<td>.25820</td>
</tr>
<tr>
<td>Male</td>
<td>2.0667</td>
<td>15</td>
<td></td>
<td>.25820</td>
</tr>
<tr>
<td>Total</td>
<td>2.0667</td>
<td>30</td>
<td></td>
<td>.25371</td>
</tr>
</tbody>
</table>

Table #4.1: showed the t-test compare mean

T-test compares means used to assess the gender difference in this study so this t-test applied on the gender difference. In the above table mean average scores showed that there is no gender difference founded in the tables. So hence prove that H05 accepted.

iii. Using of linear regression

H06: Cost would be predicted the developers participation and experience.

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.128*</td>
<td>.016</td>
<td>-.057</td>
<td>3.44211</td>
</tr>
</tbody>
</table>

a. Dependent Variable: COST

b. Predictors: (Constant), Experience, Developers participation

Table#5: showed linear regression

In the above table linear regression analysis result indicated that cost predicted the 16% experience and developers participation. So the H06 is accepted.

H07: Time would be predicted the change of Request and Module / sprint formation.

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.303*</td>
<td>.092</td>
<td>.024</td>
<td>2.51413</td>
</tr>
</tbody>
</table>

a. Dependent Variable: Time

b. Predictors: (Constant), Change of request, Module/Sprint Formation

Table#5.1: showed linear regression

In the above table linear regression analysis result indicated that time predicted the 92% change of request and module/sprint formation. So the H07 is accepted.
**H08**: Requirement understanding would be highly predicted the manger role, self made team and language.

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.000*</td>
<td>1.000</td>
<td>1.000</td>
<td>.00000</td>
</tr>
</tbody>
</table>

a. Dependent Variable: Requirement understanding  
b. Predictors: (Constant), languages, Manger role, Self made team

*Table#5.2: showed linear regression*  
In the above table linear regression analysis result indicated that requirement understanding predicted the 1.000 % language, manger role and self made team. So the H08 is accepted.

**H09**: Users stories handling would be predicted the communication, team based issues.

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.051*</td>
<td>.003</td>
<td>-.071</td>
<td>.79168</td>
</tr>
</tbody>
</table>

a. Dependent Variable: User stories Handling  
b. Predictors: (Constant), Team based issues, Communication

*Table#5.3: showed linear regression*  
In the above table linear regression analysis result indicated that user’s stories handling predicted the 3% teams base issues and communication. So the H09 is accepted.

**Conclusion:**  
Our solution is selecting the persons who have the same language expertise to develop the project. This feature will enhance the selection process for the current project with the same language expertise of developers. The previous project language supports the selector to select developers with the language so that the project can complete on time and within the cost. Whenever the change request come from the client the developer can easily complete the change request.

**REFERENCES**


[59] Cooper, Robert G., and Anita Friis Sommer. "Agile–Stage-Gate for Manufacturers: Changing the Way New Products Are Developed Integrating Agile project management methods into a Stage-Gate


