



**A STUDY ON APPLICABILITY OF THE SCRUM, AGILE PROJECT  
MANAGEMENT APPROCH ON EPC/EPCM PROJECTS**

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I must also thank Ashish Bagate for his valuable support.

A handwritten signature in black ink, appearing to read 'Satish S Kshirsagar'. The signature is fluid and cursive, with a long, sweeping line extending upwards and to the right from the end of the name.

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## Declaration by the Guide

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Further, I certify that the work is based on the investigation made, data collected and analyzed by him and it has not been submitted in any other University or Institution for award of any degree. In my opinion it is fully adequate, in scope and utility, as a dissertation towards partial fulfillment for the award of degree of MBA.

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## **ABBREVIATION**

PM - Project Management

APM - Agile Project Management

MSP - Microsoft Project

DPR - Daily Progress Report

EPCm - Engineering, Procurement and Construction Management

EPC - Engineering, Procurement and Construction.

IFD - Issued for Design

IFC- Issued for Construction

FEED - Front End Engineering Design

# 1 INTRODUCTION

## 1.1 OVERVIEW

At present, project management is a highly discussed topic in EPC/EPCM industry. The way of project management methodology has not changed significantly from the 60's in different sectors. This situation leads to a problem for managerial perspective and how EPC/EPCM projects are executed has a large gap in between.

The agile project management approach is mainly suited for complex projects, where it is difficult to specify requirement and final deliverables in advance. It is adopted by so many industries/departments, where they are able to detect the problems by repetitive tests and constant improvements.

There are many advantages found of implementing an agile approach to increase participation of each member of the development team in the project compared to the present situation. Moreover, it increases client's involvement and more focused employees' group. On the other hand, it decreases delay, uncertainty, and risk involved during the engineering/construction phase. It is also focused on time management and regular meetings, that will be beneficial to keeping track of the project's progress.

## 1.2 BACKGROUND

Project management is a key to finding the way of managing, controlling and coordinating any size of the projects by choosing working methods, defining project roles, simplifying project reporting and constantly following project planning throughout the project. Today, project management often affects the entire organization, be it a small company or a larger public company.

It's been half a century of managing projects with using traditional methods and on which the development relies. The actual way of managing projects have changed now. There is a gap between a traditional view on managing Engineering projects

and new methods of managing projects that creates uncertainty within the company and the people working there. People today are sometimes aware that they are working in a way that does not always confuse the management view. Investigating and defining how projects are actually managed and executed today can reduce uncertainty and confusion. Another possibility could be to explore the possibilities of using an already defined management approach, which is the subject of this research .

At start of engineering phase of a project, when all the things are uncertain and unplanned. Moreover, the amount of money spent increases constantly for construction phase if things are not handled properly. Once the Engineering phase of the project starts, not recognizing the mistakes and errors may become very costly in term of time wasted and in money spent. So, it is necessary to observe these mistakes and errors to make them unrepeatable.

### 1.3 AGILE PROJECT MANAGEMENT

*"A traditional project manager focuses on following the plan with minimal changes, whereas an agile leader focuses on adapting successfully to inevitable changes."  
(Jim Highsmith, Agile Project Management: Creating Innovative Products)*

Agile project management has its roots in the software development industry, and it has developed through empirical progress. This methodology's uses are not limited to that industry. It defines values and principles, that can be adopted by other industry as well. Moreover, it includes different tools and methods of conduction a project, which will lead to follow its values and principles. The agile methodologies are widely used by the software development industry where the customer recognized his need and improving it by repeated tests.

*"Agile is a substantial and nuanced change to the way you think about doing things. It's an organizational change."  
(Justin warren, PivotNine, Melbourne, Australia)*



Following are the main concepts within the agile project management:

1. Adoption to change
2. Collaboration between people

#### **1.4 NEED FOR THE STUDY**

There is a large number of money invested in a Refinery, Oil and Gas projects and chemical projects. These projects actually shape our environment and living. Though it is necessary to accept that market is changing constantly and the EPCm industry must take counter measures to keep up.

A traditional concept of management, the responsibilities and authorities are defined in a hierarchy, so if a middle level chain is broken than the ground level subjects is failed. In agile concept, the basic belief is to keep all responsibilities & authorities on the same level such that even if there is a failure in single subject, the remaining subject can work efficiently in their sectors.

The basic concept of management is that the number of people & activities to be managed are directly proportion to the no. of problems and issues to be addressed in management. Agile management could be beneficial in minimizing the delays in engineering phase of the project which will help in execution, technical instructions, planning and avoid delay in the Engineering and construction phase of the projects.

#### **1.5 OBJECTIVE AND PURPOSE OF THE STUDY**

To study the adaptability of agile project management (Scrum) and its resulting effects on the engineering execution of the projects.

The purpose of this research is divided in following two parts:

1. A Systematic literature review that investigates the Scrum.
2. Study the live project ,Scrum model to examine the relationships between various factors that affect the project performance in large scale EPCm projects.

## 1.6 SCOPE OF WORK

The scope of work is limited to the Engineering phase of projects. Opportunities, disadvantages or other potential impacts that could exist on other types of projects or other phases of Engineering projects are not considered, taking into consideration case study of Oil and Gas project executing in one of MNC office in Navi Mumbai, where SCRUM methodology is being used in EPCm phase of the projects.

Following is the research question and the topic of this research :

**What are the benefits of implementing Agile project management in the Engineering phase of the projects?**

Following question has to be investigated to get possible answers:

**What are the roadblocks to implement agile project management in the Engineering phase of projects ?**

In order to answer above questions, adopted a two-phase approach.

The first phase involves conducting a systematic literature review of past empirical research. The main goal of this review is to investigate adaptability of Scrum for EPCm projects by identifying currently used practices and challenges faced while adapting them. The second phase involves the study of a live EPCm project.

## 2 LITERATURE SURVEY

### 2.1 TRADITIONAL/WATERFALL PROJECT MANAGEMENT:

Traditional project management[10] is used worldwide in Engineering industries. It is also known as Waterfall project management. Traditional project management is consist of one predefined path that whole organization follows, which includes following five stages: Initiation, Planning, Execution, Monitoring and controlling, Closing. It has a set of Engineering techniques that helps project to achieve success on time, within budget and fulfil given specifications. It is mostly used where the changes to be made during Engineering is very rare. Traditional project management is mainly based on the experience. Traditional way helped project management to grow progressively. As a result, the ultimate goal was to complete the project follow below predefined sequence of traditional project management.

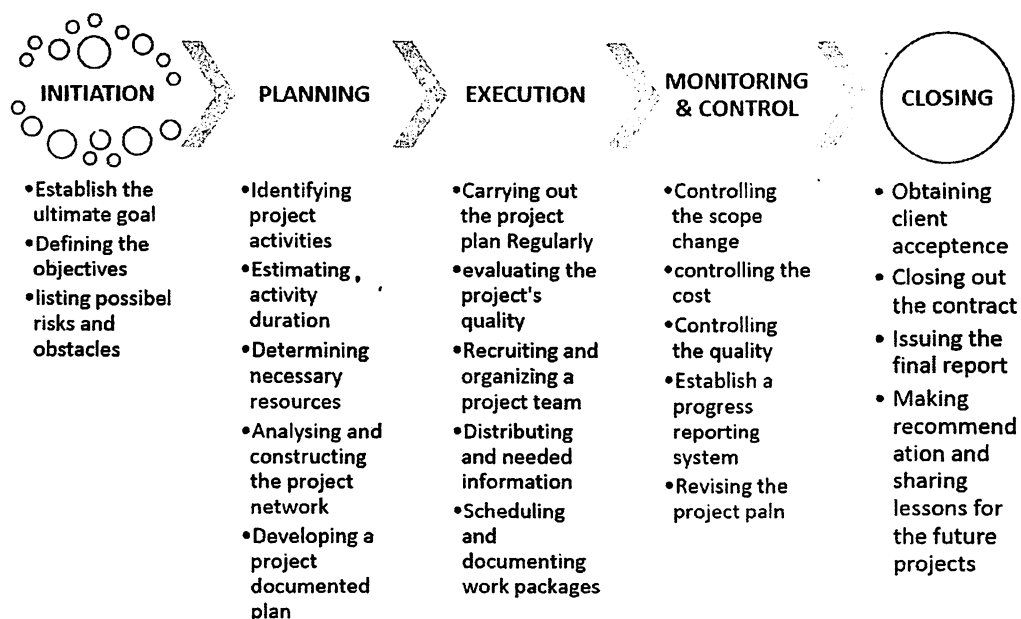


Figure : 01 Traditional water fall project

## 2.2 SCRUM

### 2.2.1 INTRODUCTION

Scrum is defined as an agile approach to the development of a project. However, it must be understood that scrum is not the full process but only a framework that supports the agile methodology. Scrum is completely based on agile software development practices, especially the scrum approach was applied to software product management. It should be noted that Agile project management tools differ significantly from regular software development and management tools.

### 2.2.2 HISTORY

Scrum was taught first time in mid-80's of 20<sup>th</sup> century, when two Japanese professors from management practices Hirotaka Takeuchi and Ikujiro Nonaka have published an article "New production development game". They wanted to improve production processes by working with people from different areas of an organization work together as a team. These teams conduct a complete development from the beginning to end. They have argued that this had a positive impact on the productivity and delivering quality within the teams. This approach to management is called "rugby" approach. Where the team works together, passes the ball back and forth and moves as a unit. That term is known as Scrummage and from that the word "Scrum" is derived.

After some years, two American software developer Jeff Sutherland and Ken Schwaber jointly represented a framework for product development at a conference held in Texas in 1995, which they called Scrum and That was mainly focused on the software industry. After successful implementation, it gained knowledge and experience to work with it in other industries.

### 2.3.3 OVERVIEW

A Scrum project involves a collaborative effort to create a new product, service or other result as defined in the Project Vision Statement. Projects are impacted by constraints of time, cost, scope, quality, resources, organizational capabilities and other limitations that make them difficult to plan, execute, manage and ultimately succeed.

However, successful implementation of the results of a finished project provides significant business benefits to an organization. It is therefore important for organizations to select and practice an appropriate project management approach.

Scrum is one of the most popular Agile methods. It is an adaptive, iterative, fast, flexible, and effective framework designed to deliver significant value quickly and throughout a project. Scrum ensures transparency in communication.

The subsequent sub-sections reveal the principals and practices behind the power of Scrum.[8]

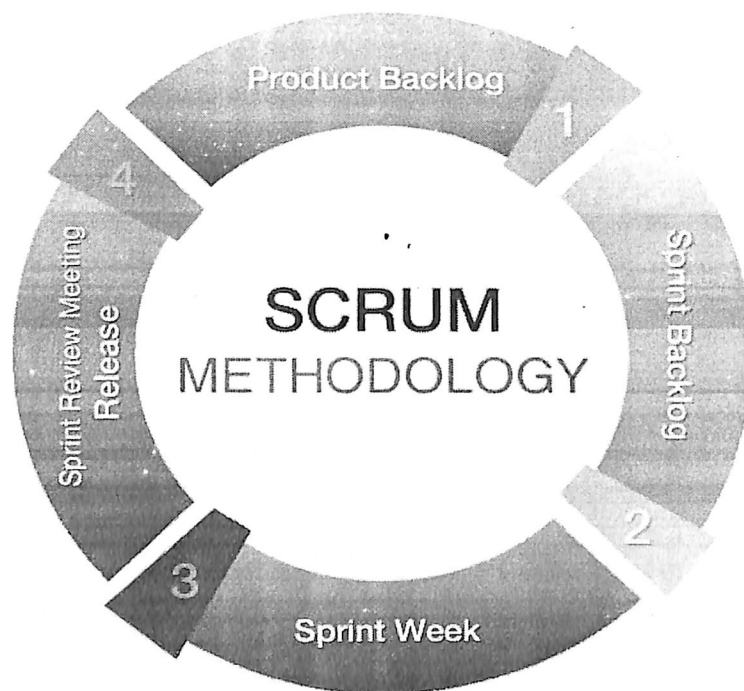


Figure:02 SCRUM METHODOLOGY [8]

### 2.3.4 SCRUM ROLES

Scrum mainly defines four roles:

#### **Scrum Team**

Scrum Team contains the Development team and a Project/Product Owner. Ideally, it is comprised of maximum 10 people. the group of people developing the product. There is no personal responsibility in Scrum, the whole team fails or succeeds as a single entity.

#### **Development Team**

Development Team is the one who actually implements the work on a project. An ideal development team consists of the people who has necessary skills and planning of doing task.

#### **Scrum Master**

The Scrum Master makes sure that the team can work unrestrained and possible roadblocks for the team are treated accordingly. The Scrum Master ensures that everyone participates in daily meetings, keeping everyone up to date on the latest developments.

#### **Product Owner/ Project Owner**

Project Owner is not a part of the development team. That is the person who manages what the team works on during a Sprint, comparable to a Project Manager in a typical software development process. The Product Owner is the Scrum team member who is responsible for prioritizing/changing and adding items to the Product Backlog, based on feedback from the customer and other stakeholders. He or she is the link between the business and development.

### 2.3.5 SCRUM ARTIFACTS

The level of artifacts consists of:

- 1) Release
- 2) Sprint
- 3) Backlog Items
- 4) Tasks

#### **Release**

Release is a combination of work achieved in number of sprints. In Engineering industry, Release is defined as one activity and sprints are defined as sub-activities. In practice this sprint varies from activity to activity.

#### **Sprint**

Sprint can be defined as a sub activity as explained above. In Engineering industry, it can be a period of work performed in 30 days or less to create deliverables. As the level of activities are more in Engineering industry, sub-sprints can be generated ( Example: IFD to IFC etc. ) Scrum uses fixed-length iterations, called Sprints, which are typically two weeks or 30 days long. The Sprints are time boxed – they end on a specific date whether the work has been completed or not and are never extended. Usually Scrum Teams choose one Sprint length and use it for all their Sprints until they improve and can use a shorter cycle. Scrum teams attempt to build a potentially shippable product increment on iteration.[4]

The Scrum framework, shown in Figure 01, is first initiated by collecting requirements in the form of user stories from the customers, the teams and other stakeholders. All of these user stories are arranged in priority order in the Product backlog. The high priority items are selected from the product backlog to be implemented in the next Sprint. During the Sprint, no new items may be added. At the start of the Sprint, a planning meeting is held where team members figure out how many items they can commit to, and then create a sprint backlog – a list of the tasks to perform during the Sprint. During each Sprint, the Scrum team works on development of the requirement including its design, implementation and delivery.

At the end, these features are coded, tested and integrated into the evolving product or system.

For every Sprint, a daily scrum meeting is held for discussing the current progress and impediments. The result of each Sprint is a potentially shippable product increment. Thus, each Sprint provides a working functionality for the product. At the end of the Sprint, the Team reviews the Sprint with stakeholders, and demonstrates what it has built. Feedback obtained from participants is incorporated in the next Sprint.

### **Backlog Items**

Backlog items are the set of backlogs, Sprint backlogs and product backlogs.

Where, backlog is the description of work to be performed for the particular sprint. Sprint backlog is work to be done during the ongoing sprint and the product backlog is description about work to be done for the whole project.

The Product Backlog is a prioritized list of project requirements with estimated times to develop them into completed product functionality. The Product Backlog is continuously updated to reflect changes in the needs of the customer, new ideas or insights, moves by the competition, technical hurdles that appear, and so forth. The product owner is responsible for prioritization of the product backlog items after consulting from the team and stakeholders involved. All the entries within the Product Backlog have to be estimated in terms of either story points, function points or simply point. This estimation can then be used to prioritize entries in the Product Backlog and to plan releases. The Team and the Product Owner decides the effort estimate and technical risk estimates for each item in the product backlog.

The larger items in the product backlog are broken into smaller items and assigned individual priorities. This is referred to as product backlog refinement. The Product Backlog items for the future Sprints should be small and fine-grained enough that they are well understood by the team and they make near to concise estimates.



### **A. Sprint backlog**

The Sprint backlog is a list of tasks identified by the team to be completed during the upcoming Sprint. During Sprint planning meeting, the team selects the highest priority items from the product backlog, usually in the form of user stories, and identifies the tasks necessary to complete each user story. Most teams also estimate how many hours each task will take someone on the team to complete. Only team is authorized to change the item selection within the sprint. The tasks should be detailed in terms of man-hours. The tasks are measured in hours whereas the product backlog items are measured in relative story points. The tasks include information about the work that has to be accomplished. Sometimes Sprint backlog is linked with the product backlog to trace the progress of the product backlog items. The Sprint Backlog can be kept electronically within e.g. an Excel-Sheet or with cards on a task board. An example of Sprint backlog in a spreadsheet is shown in Figure 02. During the Sprint, team members are expected to update the Sprint backlog as the tasks are fulfilled. Many teams will do this during the daily scrum.

### **B. Sprint Burn-down Chart**

Sprint Burn-down Chart is a graph used by the teams to track the development effort remaining in a Sprint. It shows, each day, a new estimate of remaining work until the Team finishes it. It is called 'a burn-down chart as it is downward sloping graph and reaches zero by the last day of the Sprint. Every day the team member's work on tasks and the work should decrease every day. Usually on horizontal axis, time or number of Sprints are plotted while on vertical axis, work remaining (Story points or man-hours) is plotted. There is another chart used in the Scrum framework called as release burn-down chart which shows the remaining work in the release. The release burn-down focuses on the requirements rather than tasks. On the horizontal axis Sprints is plotted instead of days. It means that Sprint burn-down shows the status of Sprint backlog tasks while release burn-down shows the status of the product backlog items.

## Task

A backlog items is broken into the small work is called tasks. Tasks are generally estimated in hours. Every scrum development team member has to choose the task he or she want to work for the particular day. Tasks are depends on which element he or she is doing. Normally, these tasks lies between 5 to 20 hours.

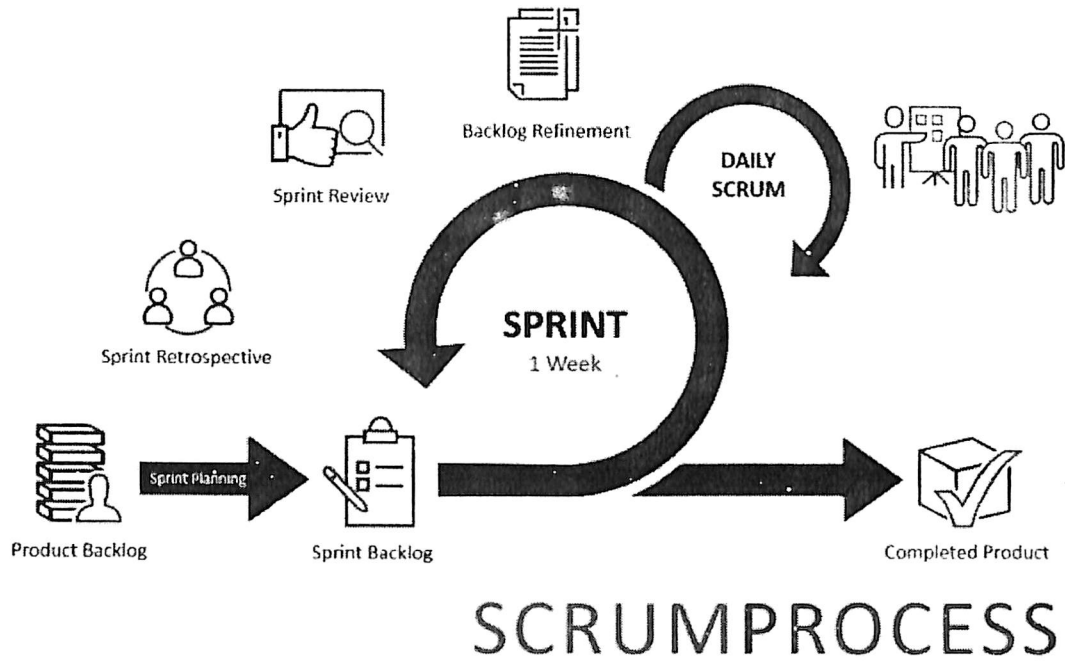


Figure:03 SCRUM PROCESS [9]

### 2.3.6 SCRUM PROCESSES

- Sprint Planning Meeting
- Daily Scrum/Stand-up
- Sprint Review

#### **The Sprint Planning**

The sprint meetings are held in cooperation with the product owner/PM. In which, each member of development team decides to take up a sprint which is moved from product backlog to sprint backlog.

At the beginning of each Sprint, the Sprint Planning Meeting takes place[7]. The maximum duration of the meeting is five percentage of the Sprint length. The inputs to the Sprint planning meeting are the team capacity and the product backlog . The meeting is divided into parts, each also time-boxed. During the first part, the Product Owner presents the highest priority Product Backlog items to the team. The team and the Product Owner collaborate to help the team estimate how much Product Backlog it can develop into working software in the upcoming Sprint. The second part of the meeting focuses on how to implement the items that the team decides to take on. The team estimates the number of items from the product backlog they can complete by the end of the Sprint. The higher priority items are first selected for the implementation

#### **Daily Scrum/Stand-up**

Each scrum meeting runs daily for around 15 minutes, during which the project manager asks three questions:

1. What did you do yesterday or since last scrum meeting?
2. What are you doing today or going to do today?
3. What will you do before next scrum meeting?

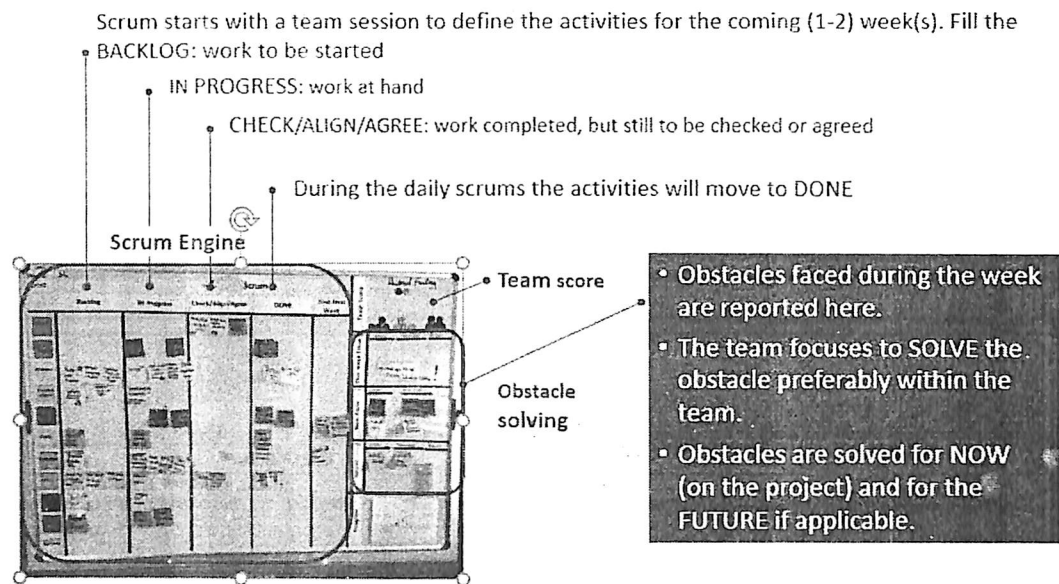


Figure.04 Scrum Board Explained[9]

### Sprint Review and Retrospective

In the sprint review, the product owner/PM reviews each sprint chosen by the development team members, that is explained to customers or the stakeholders. Along with the demonstration. This is the only time when the customers or the stakeholders can give inputs or suggestions to the project owner.

After the Sprint ends there is a meeting where people review the Sprint. The Product owner, ScrumMaster, team and all the stakeholders participate in this meeting. In this review what has been accomplished in the Sprint is discussed. The Sprint Review is an inspect and adapt activity for the Project. The Sprint review should be no longer than 30 minutes. The Sprint Retrospective, which follows the Review, is an inspect and adapt activity regarding the process and environment. In this meeting, team discusses which practices are proving beneficial and which are not. It is time boxed for 45 minutes per week of Sprint

### **3 RESEARCH DESIGN, METHODOLOGY AND PLAN**

The Research Questions and Research objective described in the introduction chapter results in following selection of research method. The type of studies varied from survey, case studies, observations, interviews and questionnaires.

#### **3.1 CHOSEN RESEARCH METHOD**

The research method for this research is combination of qualitative and quantitative. For the qualitative part, Questionnaire survey is conducted to know the process of execution in terms of project management. Moreover, these survey forms are conducted with the Leads of particular projects (Project Managers, discipline leads and Planning engineer etc.) who has knowledge of scrum or agile project management?

For the Quantitative part one project was considered , which were using Agile Project Management (Scrum) approach in the Engineering phase of the project. Project managers and Leads of the particular projects were interviewed to get the opinion about how the Engineering phase is managed through agile project management.

Feedback is mainly focused on theoretical knowledge that how one can apply agile project management tool in the Engineering phase of projects and to learn what actually agile project management approach means.

#### **3.2 REFLECTION OF CHOSEN METHOD**

The qualitative approach was chosen to gain understanding of this topic. It is less structured and more explorative than the quantitative approach and it is suitable for observing organization, groups or individuals and the quantitative approach was chosen to compare primary data, which are collected from projects selected as case study. The chosen research process allowed the exploration of new areas that are relevant to the topic.

### **3.3 DATA**

In this research, primary and secondary data has been used. The primary data comes from the case study and interviews and the secondary data is consist of literature study and knowledge gained from research papers.

### **3.4 INTERVIEW PROCEDURE**

Questionnaire is prepared based on the literature study. It is mainly divided into following three parts:

1. Respondent's Details
2. Project Details
3. Scrum survey form

In which, Respondents have to fill their personal details and project details on which they are working. Leading to Scrum survey form, the questions were mainly focused on scrum as whole. From knowledge to on project working conditions. From daily scrum meetings to scrum retrospective. The respondents has to rate the importance of all these factors between 1-5. In which, 1 indicates least important and 5 is for extremely important. At the end respondents were free to give their suggestions, recommendations and views about the agile project management/Scrum.

### **3.5 CASE STUDY**

As this research is conducted with the help of JACOBS ENGG. INDIA LTD., case studies are chosen from their ongoing "CONFIDENTIAL" project in Navi Mumbai office. It has been done through participation and asking question to Project managers and participant Leads. Researcher can not participate in daily scrum meetings day to day life due to time limitations and "CONFIDENTIALITY" of the project. To know some insights interview technique was used. It is also a useful because it gives insight into what people actually do and think, not just what they claim. Working on projects of Jacobs and access their way of documentation and reporting office conversations has contributed to the contextual awareness of the outcome of the research.

Jacobs is a multidisciplinary Engineering company offering a diversified range of Engineering and allied services across Oil and Gas, Chemical and Refinery projects in India and in Global. They provide services across the Engineering value chain, ranging from planning, Engineering and post-Engineering construction support activities ( EPCm) to most of the clients.

### **3.6 RESEARCH ETHICS**

Research was allowed by Project Manager based on “CONFIDENTIALITY” of the project name/persons involved during research work. Hence only disciplines will be named in feedback and data collection.

## **4 FINDINGS AND ANALYSIS**

This chapter will present the data collected from the Scrum meeting and one to one conversation required for case study. Each of the section is structured according to the topic and findings from on-site observations.

### **4.1 QUESTIONNAIRE SURVEY METOD**

Questionnaire survey form is prepared based on the literature study. While doing the literature study, some of the important questions, topics and data was observed. The data observed from literature study was categorized further into topics it belongs. Based on the data observed, the entire survey form was divided into following three parts:

1. Respondent's Details
2. Project details
3. Scrum survey

#### **4.1.1 RESPONDENT'S DETAILS**

The main target group was, people who are currently working on project which are using any agile project management tool or scrum in this phase of the project and who has knowledge about the agile project management approach and tools. This section of the questionnaire survey form contains the basic information employment industry, working experience in Engineering field and their role on project. This is to identify the experience in industry they are currently working. Experience of work by using agile project management approach/Scrum tool on agile projects.

#### **4.1.2 PROJECT DETAILS**

This section represents details about projects, No. of employees working on their project and Project's budget. These details were included in survey form to get deeply knowledge about the projects they are working on. We can know that, which companies are using agile project management on their projects and level of complexity of their project. Followed by what project management methodology companies are using on their current and past projects.



#### 4.1.3 SCRUM SURVEY

In this section, questions were asked to respondent, which all are related to Scrum along with suggestions and recommendations. This section was mainly based on scrum generalized questions. The respondents were asked the questions about scrum role, scrum artifacts and scrum processes.

Scrum processes is one of the major factors for well implementation of scrum on any project. There were questions about daily scrum follow up. Some of the important questions are listed below:

- How often is scrum used in your company?
- In which phase scrum is applied in your company?
- Is scrum really working on your project?
- Is there any gap between the way scrum teams are run and the way rest of the company is managed?
- How successful are your projects, if it is managed from APM?
- What are the success factor that lead your company to adopt scrum?
- Are there any challenges faced by your organization in achieving goals with Scrum?
- Does your team hold scrum meeting daily?

## **4.2 DATA COLLECTION FROM CASE STUDIES**

The main reason for doing this research is to compare on-site scenario while implementing Agile project management. As a part of quantitative research, selection of case studies was very difficult.

### **4.2.3 LIST OF FORMATS AVAILABLE**

**Daily Scrum Format-** This format was prepared to keep track on daily scrum meetings. Jacobs has prepared a format to document daily scrum meetings. The format is as per Figure 04. In which, the presence of each member is marked by scrum master and details of work for a particular day is written in front of disciplines. Each discipline uses designated color to differentiate the activities.

**Sprint Planning-** Sprint planning is like a daily progress report. In this weekly cycle for a single sprint. For that, the planned data is taken from MS project file as per planned schedule and to compare it to actual work at the end of every sprint.

**Sprint Review Report-** This report is prepared at the end of every sprint, containing sprint details (duration, planned work and actual work), summery of daily scrum and conclusion of each sprint.

## 5 INTERPRETAION OF RESULTS

This chapter will represent the information about how the analysis is done on the project team which is implementing SCRUM practice on the project in terms of progress and delay.

Response from targeted group of people only i.e. Discipline Leads and PM, who are working in Engineering project and having knowledge about agile project management were the main target group, people using scrum on their projects are preferred more. Mainly the technical persons (like project managers, scrum masters, Planning engineers etc.) were considered for better responses.

Leads of individual discipline plays the most important part in success of any project. They have to be more focused and productive towards the project. For that, scrum suggest to employ more qualified and experienced team members from various departments for better understating of project. Another important process that scrum defines is "Daily scrum meeting". Daily scrum is all about regularity, sincerity, more communication and to keep everyone updated about the project. Scrum defines that the size of project team should be between 6-10 for better implementation. They were also asked questions about daily scrum meetings to know the regularity of users. And the response rate was quite good, users were conducting daily scrum meeting on regular basis, mostly in morning time. which is the best time for daily scrum meetings.

Following are the common factors identified for the literature survey of scrum :

- More communication within team
- Participation of each member
- Few levels of management research
- Widely shared information
- Adaptive to change
- Continuous improvements
- Self-controlled

## 6 CONCLUSION

In this chapter, it will implies the conclusion in respect to research questions stated in initial stage of this research .

### 6.1 RESEARCH QUESTIONS

1. What are the benefits of implementing Agile project management in the Engineering phase of Engineering projects?
2. What are the roadblocks to implement agile project management in the Engineering phase of projects?

### 6.2 ANSWERS

Scrum is the most popular agile framework used for project management. Over the past decade, as its popularity grew, the industry began to scale Scrum to suit larger organizations and achieved mixed results. Many projects used Scrum successfully , whereas few failed dramatically and resulted in abandonment of the Scrum. In some vital and time critical projects, selection and adoption of process plays a very crucial role. In such projects, there is little or no room to undertake a risk that can cause project's failure. Therefore, before adopting any process, one must be confident of its results. This research has been carried out to provide insights and recommendations for how to scale Scrum to make it adaptable to most of the projects. These findings might help the management to decide whether adopting Scrum for their projects is appropriate or not.

The objective of this research is to investigate management challenges in adopting scrum for large scale projects and to find and elaborate SCRUM practices used.

A two-phased approach was adopted where in the first phase a systematic literature review was conducted and the second phase involved the case study for EPCm execution of the project.

The major advantage of implementing agile project management in Engineering phase of the project is to increase communication within team.

It will give them a freedom to think individually and to work as per their own. As the agile project management/Scrum follows the bottom-up project management approach, that leads lower level employees to think independently.

Agile approach will also motivate their personal experience as they are given more responsibility and a higher level of authority. This will lead them to deliver work as best as possible. Through the way of execution methodology, the client will be forced to increase their participation more or less for better delivery of work. Implementing agile project management will also result in client's satisfaction in the end of the project. This is because this approach manages the product backlog, including the customer's requirements for the project.

The way Scrum approach uses time management, it will provide the industry a proven tool to track the progress and status of the project. It is one of the easiest to implement in compare to other tools. Since one can start with a small project and can implement it in any big or complex projects possible. And it will constantly add the improvement in current project management process and other tools.

The agile approach is also focuses on initial stages of project like Conceptualization and FEED phase to know what client actually needs for their projects. It mainly focuses on communication between parties, to develop a solid vision for the project.

To summarize the conclusion, the implementation of agile project management approach in Engineering phase of project will decrease uncertainty and risk. It will help with planning activities during the Construction phase and one can decrease delay by scheduling, using time management, daily scrum meeting, sprint retrospective meetings and increasing both employees motivation and client's involvement.

### 6.3 RECOMMENDATIONS

First, recommend to educate more people in Engineering industry about agile project management approaches and Scrum by organizing introduction and training workshops. The companies should be educate key persons of development team like project managers and scrum masters. These roles are playing important roles because they are the people being together can adopt a method and replace the current project management method.

While testing an agile project management approach for the first time, it is better to keep limited to your organization, as the client may not be able to fully agree on the chosen new working method.

Any company has to start using this approach in discipline. They have to take regular follow up with daily scrum meetings and to keep burndown chart updated every day. They have to build an environment where the team can discuss and work together. There should be a white board, where all the team members can keep track of prioritized activities and tasks by using notes.

While implementing for the first time with Scrum/Agile project management approach, the team members should not consider this project as a trial project or pilot project. It can be an excuse for failing at the end. They may not embrace this new approach properly if they will take it as a trial project. The organization has to say that we are going to implement Scrum properly and we are going succeed this in our projects.

The major advantage about implementing this approach, is that anyone can start it with a small change and can adopt it as per they convenience. Other benefit is, we can improve the progress by using Scrum with other agile project management tools (like Kanban, Lean, etc.). That process of merging two agile approach is called hybrid scrum.

## 7 FUTURE RESEARCH AREAS

To understand how the transition from today's way of implementing Engineering projects in the agile way, a "translation" of the agile approach to the Engineering industry has to be studied and developed. It should, firstly, encompass the various roles and their responsibilities and powers, and secondly, how the way in which sessions are shaped and conducted changes.

As the chosen research topic is mainly focused on implementation phase. Scrum can also be implemented in other phases of Engineering projects like Construction phase. Further research can be done in consideration of Cost and Quality of Engineering.

A topic for future research may be to focus on a small-scale side of agile project management and what areas it could involve in the implementation in the Engineering industry. Another topic may be to focus on related topics, such as customer satisfaction, efficiency and involvement, and to see how they can be improved through the implementation of agile project management.

Another important survey regarding agile project management is to investigate the mind-sets of people working in Indian Engineering industry. Are the people working in Engineering industry ready to change and adopt or will any attempts at change encounter opposition and be rejected?

## 8 LIST OF ANNEXURES

### 8.1 ANNEXURE 1 SCRUM SURVEY

# Scrum survey form

OBJECTIVE OF MY THESIS:

TO STUDY ON APPLICABILTY OF THE SCRUM, AGILE PROJECT MANAGEMENT APPROCH ON EPC/EPCM PROJECTS

( Tick mark the applicable option in box )

#### Personal details

1 Name of the Discipline

A

2 Reporting to

A

3 Name of the project

A

4 Location of project City and State.

A

5 In what industry are you employed?

<input type="checkbox"/>	Engineering
<input type="checkbox"/>	Finance
<input type="checkbox"/>	IT
<input type="checkbox"/>	Other:

6 What is your role on project

<input type="checkbox"/>	Project Owner
<input type="checkbox"/>	Project Manager
<input type="checkbox"/>	Discipline Lead
<input type="checkbox"/>	Planning engineer
<input type="checkbox"/>	Other:

7 Experience in engineering industry. (In years)

<input type="checkbox"/>	0-5
<input type="checkbox"/>	6-10
<input type="checkbox"/>	11-20



	21 and more.
--	--------------

**8** No. of employees working at your project.

	1-20
	20-50
	50-100
	more than 100
	Other:

**9** Which Project Management methodology you are using on your current project?

	Traditional/Waterfall Project Management
	SCRUM
	Other Agile Project Management (APM) tool

**10** Do you know about Agile Project Management (APM)? \*

	Yes
	No
	Maybe

**11** Do you know about SCRUM? \*

	Yes
	No

**Survey**

**12** How many Agile projects have you worked on in the past?

A

**13** How often is scrum used in your company?

A

**14** In which phase scrum is applied in your company?

	Design Phase
	Planning
	Implementation
	Other:

**15** Is scrum really working on your project?

	Yes
--	-----

	No
--	----

**16** Is there any gap between the way scrum teams are run and the way rest of the company is managed?  
Yes/No along with the comment.

**17** Does your company have a PMO (Project Management Office), from where scrum projects deployed and managed?

	Yes
	No
	Maybe

**18** How successful are your projects, if it is managed from APM?

	Not successful
	Somewhat successful
	Successful up to certain extend
	successful
	Highly successful

**19** Are there any challenges faced by your organization in achieving goals with Scrum?

	Yes
	No

**20** How many people are there working in your scrum team?

	1-5
	6-10
	11-15
	more than 15

**21** Does your team hold scrum meeting daily?

	Yes
	No
	Not often

**22** What time of the day does your team hold daily scrum meetings?

	Morning
	Afternoon
	Evening

23 Is there any certification required for Scrum?

<input type="checkbox"/>	Yes
<input type="checkbox"/>	No
<input type="checkbox"/>	Maybe

24 How important are following factors in your project/company?  
( Tick mark the applicable Box )

	Factors	Not at all	Slightly	Moderate	Very important	Extremely important
24	More communication within team					
24	Participation of each member					
24	Few levels of management					
24	Widely shared information					
25	Adaptive to change					
25	Continuous improvements					
25	Self-controlled team					



## 9 REFERENCES

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