A Critical review and empirical study on success of risk management activity with respect to scrum

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Abstract: - There are continuous debates about the flexibility to accommodate changing requirements in product development. Considering this factor software development organizations are using Agile-SCRUM with CMMI combines compliance with inevitability to better serve large needs of customer. The introduction of Scrum doubled productivity and cut defects by 40% compared to waterfall projects. Scrum may develop the product faster but we also need to know how they meet our quality requirements.

"Can agile methods guarantee quality even though they build up software more rapidly and can handle unstable requirements?" The aim of the paper is to present mapping between CMMI and Scrum methodology. It shows how Scrum addresses the Risk Management Process Areas of CMMI.

Key Words: Risk management, Mitigation, Specific practice (SP), Specific goal (SG)

I. INTRODUCTION

A. Scrum

Ken Schwaber first described Scrum in 1996 [1] as a process that accepts the development process is unpredictable, formalizing the "do what it takes" mentality, and has found success with numerous independent software vendors.

According to Schwaber [2], Scrum starts with the premise that software development is too complex and unpredictable to be planned exactly in advance. Instead, empirical process control must be applied to ensure visibility, inspection, and adaptation.

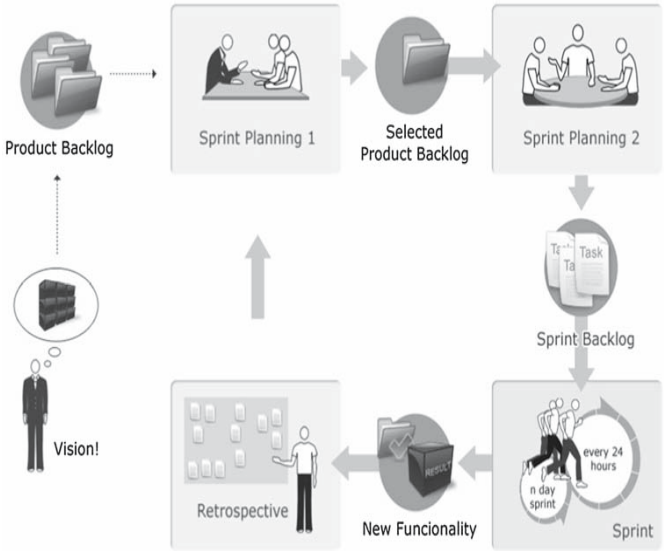

Fig. 1 Scrum process overview [3]

The paper is divided as follows: In this Section we present a brief description about scrum and a detail study about project risk areas and their mitigation strategy, and Section 2 focuses on describing in detail the specific goals and practices that help in managing the risks. In section 3 we analyze risk management with respect to scrum methodology, and the last section concludes the paper.

Scrum is distinct from others of Agile because it introduced the idea of "empirical process control." That is,

Scrum uses the real-world development of a project not a finest guess or uninformed predict, to plan and schedule releases. In Scrum, projects are divided into short and snappy work cadences, known as sprints, which are normally one week, two weeks, or three weeks in duration. At the end of each sprint, stakeholders and team members (scrum cake) get together to review the progress of a project and plan its next steps. This allows a project's way to be adjusted or reoriented, based on completed work, not on guesswork or predictions.

Fig 2 scrum cake

B. Risk Areas

Before discussing about the actual risk system in agile here we present some risk areas that are identified on most of the projects throughout the somewhere in their life cycle. The risks identified are

- Intrinsic schedule flaw
- Specification breakdown
- Scope creep
- Personnel loss
- Productivity variance

The above identified risks are the risks [4] that are common in most of the projects irrespective to the methodology that the software developing company uses to develop the project. Now here we put forward how agile address these particular five areas of risks.

1) Mitigating schedule flaw: Among the five risks the major risk is schedule flaw, which happens against the plan. Estimation is a guess of what will happen but it is not accurate. Scrum provides feedback loops to mitigate insignificant estimates. Teams make changes to the pre-plan at the end of every sprint based on last sprint time box, which gives valued information. In traditional projects they cannot find that the project developed without fresh thoughts even though their guess showing wrong results. Agile gives us the feedback loops for separating the plan into components as the product backlog to deliver value quickly by finding early opportunities.

2) Mitigating Specification Breakdown: Stakeholder's anticipations can be overcome from delivery teams if they don't have a product owner to support them about the customer needs. Mitigating specification breakdown can be resolute in agile through product owner to transmit the requirements of the customer and decisions about the product. A scrum delivery team will work together with the product owner to make certain understanding between what is to be requested and how it can be delivered.

3) Mitigating Scope Creep: Among the processes of the scrum mitigating scope creep lies as a part of scrum. In this the product owner and stakeholder by seeing the progress from the delivery team sprint they will find-out and promote new things to include in the product. At the end of the sprint the feedback from the persons attended can be taken which will be useful to generate new backlog items. Through this the product owner will assess the new product backlogs of the item and decide the action to be taken such as add, delete and trade out depending on other product backlog items.

4) Mitigating Personnel Loss: Mitigating personnel loss involves an agile project which is having self-organizing teams concerned in concentrating on work and problems to solve. This results in higher level of confidence and good sprints. Traditional projects that concentrate on "death marches" to give the work experience with low morale and a higher risk for turnover. Working in constant teams does not mean that making an agreement for life to never leave the team. There will be turnover in any team. It can be seen that the turnover will not be based on traditional project "death march" criteria - low morale.

5) Mitigating Productivity Variation: Mitigating productivity variation is the difference between the assumed and actual effect of the team. In agile projects we extend this difference to hold the performance of the product. As a part of sprint review the scrum delivery team describes the performance of the team at the end of every sprint. If any team is fading to meet its needs, they will perform less work in next iteration. If the product is failed in satisfying the customer needs, those fallouts will be corrected by the product owner's managing of the product backlog. Teams calculate approximately on how much work they can do in their first iteration. After three or four iterations, teams institute a low confidence, medium confidence, and higher confidence velocity

II. RISK MANAGEMENT

The purpose of Risk Management (RSKM) is to identify potential problems before they occur so that risk handling activities can be planned and invoked as needed across the life of the product or project to mitigate adverse impacts on achieving objectives [5]**.**

Specific Practices by Goals

→ **SG 1:** Prepare for Risk Management

- SP1.1 Determine risk sources and categories
- SP1.2 Define risk parameters
- SP1.3 Establish a risk management Strategy

→ **SG 2:** Identify and Analyze Risks

- SP 2.1 Identify risks
- SP 2.2 Evaluate, categorize and prioritize risks

→ **SG 3:** Mitigate Risks

- SP 3.1 Develop risk mitigation plans
- SP 3.2 Employ risk mitigation Plans

SG 1: *Prepare for Risk Management:*

To identify, analyze and mitigate risks proper scheduling is to be made by establishing and maintaining a strategy. These preparations are mainly documented for the risk management plan. The risk management strategy specifies particular action of management approaches, which are applied to control the risk management program. The strategy includes identifying the sources of risks, categorize the risks and the parameters. These parameters are used to evaluate, bound and control risks for effective handling.

SP1.1 *Determine risk sources and categories*: The risk source detection provides a basis for systematic probing of changing situations from time to time, to overcome the condition that affects the ability of project to meet its objectives. For a project the risks are both internal and external, as the project steps forward additional risk sources are identified. Categorizing the risks provides a method for gathering and to sort-out the risks. It also ensures appropriate analysis and the management attention of such risks that have more serious consequences on meeting project objectives.

A .Risk Sources: For a project or firm risk sources are primary drivers that cause risks. These risk sources detects the common areas where risks may be initiated. For a project both internal and external risk sources include the following.

- Indecisive requirements
- Unprecedented efforts
- Impracticable design
- Lack of technology
- Impracticable schedule estimates or allocation
- In-adequate staffing and skills
- Cost or funding issues
- Lack of subcontract capabilities
- Poor vendor capability
- Lack of Proper communication with genuine or probable customers or with their representatives
- Interruptions to continuity of operations

B. Risk Categories: Risk categorization includes collecting and organizing different types of risks. These categories of risks help in future at the time of risk mitigation plans. The following factors are considered while determining risk categories.

- The phases of the project's lifecycle model
- The types of processes used
- The types of products used
- Program management risks (contract risks, budget or cost risks, schedule risks, resources risks, performance risks and supportability risks)

SP1.2 *Define risk parameters:* Risk parameters provide reliable criteria for comparing the various risks that are to be managed. Excluding these parameters it would be very tricky to estimate the severity of the unwanted changes caused by the risk and to consider the necessary measures required for risk mitigation planning. Parameters for evaluating, categorizing and prioritizing risks include the following.

- Risk likelihood (probability of risk occurrence)
- Risk consequence (impact and severity of risk occurrence)
- Thresholds to trigger management activities

SP1.3 *Establish a risk management strategy:* Risk management strategy should be directed by a common visualization of achievement that describes the desired results of the project in terms of the product that is delivered, its cost, and its suitability for the task. The risk management strategy is often documented in an organizational or a project risk management plan. The risk management strategy is evaluated with appropriate stakeholders to support dedication and acceptance. A wide-range of risk management strategy addresses items such as the following:

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- The extent of risk management effort
- Methods and tools to be used for risk identification, risk analysis, risk mitigation, risk monitoring and communication
- Project-specific sources of risks
- How these risks are to be organized, categorized, compared and consolidated
- Parameters including probability, results and thresholds for taking action on identified risks
- Risk mitigation techniques to be used, such as prototyping, piloting, simulation, alternatives design or evolutionary development
- Definition of risk measures to observe the status of the risks
- Time intervals for risk monitoring or re-evaluation

SG 2: *Identify and Analyze Risks*

Identification of risks and analyzing risks is determined based on their importance. The level of risk shows its intensity on the resources assigned to handle an identified risk and the determination of when suitable management notice is essential.

SP 2.1 *Identify risks:* Before analyzing and managing risks, they must be isolated and described in an understandable way. Risks are to be documented in a brief way that includes the situations, environment and consequences of risk when they occur.

In achieving objectives, the risk identification should be ordered in a systematic approach to seek out practical risks. The risk identification should not be a way to concentrate on every likely situation although it may be extremely impractical. The make use of of categories and parameters developed in the risk management strategy along with identified risk sources can afford control and reorganization that are suitable to risk identification. The risk management can initiate its activities with the support of identified risks. The risks that are recorded should be reviewed from time to time as to check-out the sources of risks with the changing conditions that are previously ignored at the time when the risk management strategy was last modified.

The activities of risk identification concentrate on the identification of risks. The management does not estimate the performance of individuals basing on the outcomes of risk identification activities. The following are the typical methods of identifying risks.

- Observe every building block of the project work breakdown structure to come across risks.
- Carry out a risk evaluation using a risk classification
- Conduct interview with subject experts
- Assess risk management efforts from related products
- Observe lessons-learned documents or databases
- Observe design specifications and agreement requirements

SP 2.2 *Evaluate, categorize and prioritize risk:* By using clear risk categories and parameters, the identified risks can be evaluated and categorized and its allied priority is also determined.

The evaluation of risks is needed to assign relative importance to each identified risk, and is used in determining when appropriate management attention is required. Often it is useful to aggregate risks based on their interrelationships, and develop options at an aggregate level. When an aggregate risk is formed by a roll up of lower level risks, care must be taken to ensure that important lower level risks are not ignored.

SG 3: *Mitigate Risks*

Risks are handled and mitigated, to reduce serious impacts on achieving objectives. The steps included in handling risks are developing risk handling alternatives, observing risks and when limit is exceeded, and the risk handling activities are to be performed. To practically reduce the possible impact of risk happening, risk mitigation plans are to be developed and implemented for only preferred risks. In spite of making attempts to mitigate risks, the emergency plans are included to deal with the impact of selected risks that may occur. The risk parameters used to generate risk handling activities are defined by risk management strategy.

SP 3.1 *Develop risk mitigation plans:* A critical part in risk mitigation plan is developing alternative courses of action, workarounds and run away positions and for each serious risk developing a recommended line of action. The methods and procedures that are incorporated in risk mitigation plan for a given risk are used to keep away, cut down and manage the possibility of happening of risk or the amount of damage occurred due to the risk.

Risks are to be constantly observed, when they go beyond the limit risk mitigation plans are setup to reduce the damage level to an acceptable level of risk. If the risks cannot be mitigated, the emergency plans are to be referred. Only for those risks where the outcomes of risks are high, the mitigation and emergency plans are generated, for other risks which are good enough they simply are observed.

SP 3.2 *Employ risk mitigation Plans:* During the exertion for effective control and management of risks, a practical plan is followed to frequently observe risks, the position and outcomes of risk management actions. The risk

status should be revised in a regular time periods outlined by risk management strategy.

This action helps in finding-out new risks or new risk handling options that are necessary for re-planning and reconsideration. In both the dealings, to determine the need for applying a risk mitigation plan, the suitability limit connected with the risk should be compared against the status.

Role of Risk Management

The purpose of Risk Management (RSKM) is to identify possible problems before they occur so that risk-handling activities can be planned and invoked as needed across the life of the product or project to mitigate adverse impacts on achieving objectives [6]. In Scrum as we were discussing risks are identified, but it does not state practices to define sources, parameters to analyze and manage the risk management effort.

Scrum also does not have any policies either for critical risks based on historical sources or such related sources. Thus, the assessment, classification and prioritization of these risks occur in a casual way. As a result, all of the specific practices of RSKM are unsatisfied, except SP 2.1identify risks, because it is partially satisfied and the process area is shown in the following graph where the satisfied rate is 0.0 percent, partially satisfied rate is 14.3 percent and unsatisfied rate is 85.7 percent.

Fig 3 General coverage for risk management process area

The purpose of risk Management is to identify and analyze project risks. Scrum views a risk as a probable hurdle for the project. The risks identification happens in an iterative way, during daily meetings and registered on white-boards, flip charts or hurdles list. In practical risk identification doesn't occur in a methodical and parameterized way, for instance risk categories and sources. Thus, this practice is only partially satisfied.

III. Analysis Of RSKM With Respect To Scrum Methodology

Managing risk is prevalent in Scrum on a daily basis. Discovery, analysis, and mitigation for risk seem to happen organically in Agile, and particularly in Scrum.

But when risk management comes practically with Agile-Scrum it is not as good as with traditional management practices, as shown in the above graph[11].

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Fig 4 Importance of Risk management

A. Risk Management

With respect to scrum, risk management work with the product owner, delivery team and scrum master to determine what the risk management approach will be on the risks. Managing risk is prevalent in Scrum on a daily basis[7,8].

Fig 5 Managing risk is prevalent in Scrum on a daily basis.

While using scrum practice the risk management team will not usually prefer any documentation or informal documentation [9].

B. Risk Identification

The process of identifying risk happens on multiple levels.

- Product vision
- Product roadmap
- Release planning
- Sprint planning
- Daily stand up

1. Product Vision: Product vision is an idea of the future product. Without a vision, we lack a shared goal, a common direction. But every vision is a hypothesis: It contains assumptions about the future product including the target group. The needs of the product will address, a sketch of the product, and the value it should create for the organization developing and selling it, and these assumptions must be validated. A great way to do this is to create the minimal viable product and to release it to target customers and users.

2. Product Roadmap: The product roadmap enables identifying future release and drive exploration of the product that is being developed. At this stage the risks get well defined for further action to be taken on them.

3) Release Planning: A Release Plan is to deliver larger initiatives across multiple Sprints, with the highest priority first. The Release Plan is similar to the traditional Project Schedule in that it identifies product features and the corresponding time frames in which features will be delivered. Quality-related features, risks, dependencies, constraints, assumptions and issues may also be identified and documented as part of the Release Plan, which is generated by the Product Owner and Development Team.

4) Sprint Planning: Sprint planning is an opportunity for the team to identify and respond to risk. The only accept work they feel confident about delivering they will work with the product manager to maximize output in a way that reduce risk failure. Sprint planning should take place on the first day of the sprint.

5) Daily Stand-Up: Daily stand up meetings identify barriers and risks. Meetings are typically held in the same location and the same time each day and all the team members are required to attend the daily stand up.

In scrum, whole team involves in the multiple levels and through transparency for risk identification. Whole team is involved in scrum ceremonies and transparency.

C. Risk Analysis

The process of risk analysis on agile projects generally focuses on quality risk analysis [10] because of the sprint time boxes and constant feedback loops provided in scrum.

Scrum master is involved along with the team members to see the risks and determine what is to be done as next step.

D. Risk Response Planning

The risk response planning happens real-time as risk is identified. Whole team is involved in finding proper solutions to avoid risks, mitigate, contain or evade the risks

E. Risk Monitoring and Controlling

Risk monitoring and controlling transparency of the delivery team's work via task boards, burn-downs, daily stand-ups and end of sprint reviews provide information and forums for continuously monitoring risk.

In risk monitoring and controlling whole team is involved through their contributions to the data and feedback loops in the scrum.

IV. CONCLUSION

This study starts with general risks that occurs to a project and mitigating them, then it mainly concentrates on different goals of risks and their practices that are required to solve the problem that occur due to happening of a particular type of risk in the project. Here we analyze the risk management with respect to the scum methodology. From this study it is concluded that among the risks only identification of the risk is satisfied to some extent and the remaining part of risk management is not satisfied so the rate of success in risk management is very low compared to other activities of the project.

In the future extension of the study we intend to find a solution to counter attack other parts of risk management to increase the success rate of risk management activity. In particular, we try to find out a solution by considering the team and their roles as scrum team members.

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