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### **RESEARCH ARTICLE**

# Critical Success Factors for Agile Methodology Adaptation in Software Development Organizations

Vishvadeep Tripathi<sup>1</sup>, Dr. Arvind Kumar Goyal<sup>2</sup>

School of Computer Science and IT, Devi Ahilya University, Indore, India

<sup>1</sup>vishvadeep@gmail.com; <sup>2</sup>goyalkcg@yahoo.com

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**Abstract**— *This paper presents the outcome of our extensive literature survey and interaction with a number peer of agile practitioners. The purpose of this study is to identify critical success factors for adopting agile methodologies in software development organizations. The focus of this study to determine the critical success factor for any software development organization willing to transform from traditional software development methodology to agile development methodology.*

**Keywords**— *Agile Methodologies; Traditional software development approaches; Project Management; Team Collaboration; Training*

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## I. INTRODUCTION

Traditional methodologies are those methodologies which are predictable, process centric and need extensive planning. Traditional methodology has command and control management style, need formal communication and customer involvement is very important. It gives importance to individual roles and specialization. In traditional methodologies like waterfall, spiral etc needs detailed planning, detailed estimation and process documents in place.

Currently traditional methodologies such as object oriented and life cycle based approach are used in big and complex system development. Traditional methodologies have been used from long time and it has its proven track record. It has structure, process, technologies tools and roles in place.

An engineering based approach has dominated software development from its beginning. It follows principal of hard system thinking. The problems are fully known and can be specified in detail in the beginning itself. The approach is optimal as well as predictable solution exists for every problem. Extensive estimation and planning is the basis for predicting, measuring, and controlling real system problems and validating during the development life cycle.

The traditional development approach is process-centric, practitioners have belief that sources of variations can be easily identifiable and it can be eliminated by continuous measurement and refinement of the processes. Process has been specified and focus is always to work according to this repeatable and highly tested process. Planning and control of the project accomplished by a command and control style of management provide the thrust for developing a software product.

Using Life cycle models project manager's main work is to

- 1) specify the tasks to be performed,
- 2) Specify desired outcomes of each phase,
- 3) Assign roles such as systems analyst, programmer to individuals who will perform these tasks,
- 4) Specify process and product document which should come out after completion of each phase.

Agile methodology is relatively new methodology which is mostly used in the software development. Agile has attracted attention of many organizations in last few years. In recent years every big organization namely yahoo, Google, Nokia etc have adopted it.

Mark Kennaley [\*\*\*] has defined agile as "*An iterative and incremental (evolutionary) approach to software development which is performed in a highly collaborative manner by self-organizing teams within an effective governance framework with "just enough" ceremony that produces high quality software in a cost effective and timely manner which meets the changing needs of its stakeholders*".

Agile manifesto has been created by 17 software engineering practitioners in 2001 (<http://www.agilemanifesto.org>). They have also given agile manifesto and agile principles which has been used in the agile adoption. Agile emphasis should be given in the following points.

- 1) Individual and interaction over process and tools
- 2) working software over comprehensive documentation,
- 3) customer collaboration over contract negotiation,
- 4) Responding to change over following a plan.

Agile methodology mainly works to satisfy the customers through continuous delivery of items which has highest value for the customer. It should incorporate changes which discovered in later stage of the software development. Agile believes on smaller team of highly skilled and self motivated individuals rather than big teams. In agile design should be done for the current requirement rather than foreseeable requirement as well. Agile needs planning on sprint basis in case of scrum rather than full project plan. In agile customer support is very critical. Customer support is required throughout the project. Team collaboration is main feature of the agile development. As agile work on the smaller chunk rather than full system analysis and design, some time it does not emphasis on the futuristic risk and emphasis is given on the current cycle risk and issues only.

Now a day's Agile methodologies have proven itself and it has delivered predictable results in changing business condition. In current scenario where requirement is frequently changing, future requirement is ongoing and not clear, managers has limited budget and stringent deadline in such situation agile is best pick by the IT managers. It has given flexibility, adoptability to changing requirement and delivered high quality, high values item to the customer first.

Agile methodology does not follow the traditional method of project management. Agile methodology gives more focus on the informal method of project management. It gives emphasis on flexibility, transparency and communication. Agile project managers have less control as compared to traditional approach. Agile methodologies always give important to team collaboration, customer requirement and given emphasis to deliver high quality product to customer with small member team which has high value in less amount of time.

The remaining of this paper is organized as follows. Section 2 contains literature review. Section 3 presents the finding of this paper in the form of critical success factors. Finally section 4 concludes the papers.

## II. LITERATURE REVIEW

Literature in the field of adopting agile methodology contains a large body of research work. However, we focused this literature survey on challenges for adopting agile methodologies in any software development organization.

Hajjdiab and Taleb have presented their experience of a case study for adopting Scrum Agile practices in a government entity and identified the challenges faced by the agile teams during the adoption process and compared the findings with results obtained by other researchers in the area of software engineering. They have done the study in the government organization and identified three new challenges named as Governmental bureaucratic System, Documentation Requirements and Current Work Pressure [1].

Chow and Cao have performed a survey to explore the critical success factors of agile software development projects. They have done multiple regression analysis and given following factors that can be called as critical success factors as a correct delivery strategy, a proper practice of agile software engineering techniques, and a high-caliber team. Three other factors that could be critical to certain success dimensions are found to be (a) a good agile project management process, (b) an Agile-friendly team environment, and (c) a strong customer involvement. The study results have failed to find evidence that some assumed prerequisites for success of agile

projects such as strong executive support, strong sponsor commitment, ready availability of physical Agile facility, or Agile-appropriate project types, etc. are actually critical factors for success [2].

Boehm has mentioned that organizations must carefully evolve toward the best balance of agile and plan-driven methods that fits their situation. Hybrid of both plan driven and agile method can be used which can fit for your organization [5]. Jammalamadaka and Krishna have performed the comparison of the models and make the users aware of the characteristics of each in order to enable them to match the same with their experience [3]. Misra et al. have presented conceptual framework illustrating the relationships between the different predictor variables and agile software development success [6].

Narayan present the dynamics of agile projects by comparing it with the SDLC project framework to help the IT leaders and organizations plan effectively for transitioning to agile software development methodologies. The author has specified transition should be balancing act if the organization moves too quickly it can risk business continuity and stability. If it moves too slowly, it can put the company at a significant competitive disadvantage against competitors who take full advantage of agile capabilities. To lead the transition, IT leaders need to think about the long term organization goals, understand the current challenges, and not get trapped in the doom loop [4].

Juyun has presented characteristics and differences between traditional and agile software development methods. Author has introduced the roles, ceremonies, and artifacts of Scrum. They have found five issues and challenges which includes documentation, communication, user involvement, working environment, and Scrum ceremonies. They have mentioned that if above mentioned five issues and challenges are addressed and resolved before the project launch then organizations will smoothly produce high-quality software products using scrum [7].

Akif and Majid have presented the findings of their survey as proper training of scrum can resolve issues of scrum such as disruption in team work, immature Scrum, sprint duration and backlog management. They have specified team's has to have proper training and continuous guidance for proper maturity. Scrum maturity takes time and that time needs to be given to each and every team. Team duration need to be decided on the basis of team's capability and rate of requirement change. Product owner should take responsibility and manage the back log in proper manner so that it should not create any issues while development [8].

Boehm and tuner have suggested a guideline which should be followed by project managers to resolve various issues. They have mentioned that proper process needs to be specified for internal communication with team. Stake holders including customer, managers and practitioners need to be educated and discussion about the practices should happen. Experiences need to be shared among the team. Good people need to be picked and rewards should be given to high performer team on time to time basis [9].

Kieran et al. have specified that peoples challenges in agile methodology. Transparency of skill deficiencies , reliance on social skills , lack of business knowledge ,understanding of principal of agile ,lack of developers motivation are main issues. They have mentioned to overcome the changes in recruitment and training strategies need to be defined by organizations whenever organization is under transition to agile [10].

Mira has reported the lifecycle problems related to system and process Documentation. They have introduced role of communication owner who will communicate system and process both orally and in written. This will solve the problem of 1) what should be document 2) how much documentation required 3) when 4) and what document should be proposed [11].

### III. IDENTIFIED CRITICAL SUCCESS FACTORS

We perform extensive literature survey and did well interaction with agile practitioners with the intention to identify critical success factors. Based on our extensive literature survey we identified following critical success factors for adaptation of agile methodology practices into any organization.

#### A. *Training each and every team member:*

Before adopting agile methodology each and every member of the team must be trained according to the agile methodology. This training should include agile methodology practices to be followed by each role. Generally the biggest challenge faced by agile methodology coaches is transition of mindset of the team from traditional methodologies to agile methodology. The main issue is that for using these methods instead of traditional methods in software development, companies should change their approach from traditional to agile methodology and changing attitude from traditional to agile methodology approach.

We need to give proper training and provide the opportunity and time for developer to understand the process very well. Before joining the agile methodology project training should be given for each and every team members it includes client stake holders as well. Micro management is not a solution for agile methodology software development. In agile methodology managers should be facilitator, manager has to understand its responsibilities; it is not as it was in traditional project. In agile methodology manager has to have faith on the developers and understand their problem and then take appropriate action on the problems. Proper training and

coaching to the manager will resolve the issue of micro management. As per the human behavior developers will show resistance initially for using new approach but proper training should be given with practical scenarios so that they should adopt agile methodology and work according to the process of agile methodology.

#### *B. Executive management buy-in or support:*

Upper management buy-in is required before accruing agile methodology in the organization. It is very necessary to convince upper management and take their buy-in before starting agile methodology in any organization. Upper management is used to see the reports in a specific format on weekly and daily basis to track the project. Normally upper management has following concerns.

- How can we make sure that new features promised to the customer will be timely delivered?
- How agile methodology will impact and how the progress can be tracked?
- How will the agile methodology process impact other groups of the projects?
- When will the agile methodology project end?

Upper management who are at high levels is disinclined to surrender the feeling of control that Gantt chart, project plan and plan-driven process give them. The traditional upper management used to do the promise an extra amount of functionality on a specified date even if they know the group won't be able to do so. In the Agile methodology progress can be tracked on daily basis and false promise cannot be given.

**Tracking progress:** The detail status report which contains Schedule performance index and cost performance index, Project level risk and issues, Future planning, Completion date etc does not give guarantee that the project is going well and higher managements rely on them. Without going on the details of the actual project status higher management believes on the data and reporting which came from project plan.

In agile methodology status report includes short project description, current project state, burn down chart, defect inflow, percentage of test passed/failed and risk of the project. But it has all the relevant details of current state of the project. As it is new to the higher management it is job of the agile practitioners' to convince them with the proper justification and some time create model status reports entirely based on fictional data. It can take some time but after that higher management can be satisfied with details provided in agile methodology status report.

**Impact on other groups:** It is necessary that higher management must understand the agile methodology. Teams who are working in agile methodology, they must need to understand it very well before starting the work in agile. If two teams who are dependent upon each other are following different methodology then it may affect over all delivery of product. Business team who are providing requirement must provide requirement in the manner which is crisp and clear, and can be directly used in agile development. Priority of the stories need to specified by the product owner otherwise it will not be possible to get the desire result from the agile methodology. All the different groups should be in common page and communication gap should not be there. Communication mechanism between different groups needs to be specified. Agile methodology understanding is very much necessary for all the groups who are working with agile methodology team.

**Project completion:** Higher management is having fear that if they will choose agile methodology then project will go on for long time span. Manager is very comfortable with the model in which project budget is already approved and project is running within the budget. Managers are not comfortable if they know that project iteration will persist as long as the customer continues finding high-priority high-value work. In the agile methodology if customer feels that they are not having any high-value work they can close the project at any time.

**Project management:** Managers who are thinking that in agile methodology they cannot make commitment to customer, must need to understand that any past project plan that implied guarantees about delivery date, cost, and functionality was either wrong, heavily padded, or both. In an organization which has history of incorrect estimates, it should not be difficult to convince upper management that agile methodology process is worth trying. If organization has history of on-time delivery then you need to convince to upper management that agile methodology process could have resulted in early completion of the project or with fewer resources.

Training should be given to project managers before starting the agile methodology project; agile methodology coach should be there who are going to keep an eye on the agile methodology process for at least 2-3 sprints. There is a paradigm shift from the traditional methodology to agile methodology from the project manager's point of view. Earlier it was command and control with lot of process and documents in place. In the agile methodology projects managers should be facilitator and they should demonstrate their desire to remove obstacles as quickly as possible. Project managers should not complain if a task takes too long. Managers can be surprised but they should not jump into the conclusion, when told that task will take longer than original thought.

#### *C. Team collaboration:*

Agile methodology is based upon the team performance. In agile methodology individual expertise are not that much important but team collaboration is very important. Agile methodology suggests better and fewer people

are required rather than average people and big team. Agile methodology removes non-essential activities from the project. Developers should get more time to development. If team has good understanding of the agile methodology and fully understood the agile methodology, a development team moves very quickly. Agile methodology need top talented people because slow team workers will slow down the entire team.

Higher management can think that agile methodology will solve all the problem of the traditional methods but this is not the case. If Team is over excited about adopting agile methodology without understanding this methodology in details then it can create problem. One problem can be decrease in productivity because the development cycle took longer time due to many mistakes in implementation. This decrease productivity and lead to many team members to be less optimistic about adoption of agile methodology and loose there interest.

Agile methodology does not mean that making decision without forethought. Careful planning and discipline is required while adopting the agile methodology. In the beginning of adoption of the agile methodology when team is transiting from traditional to agile methodology, team and higher management must expect productivity degradation as team is learning new techniques. If team and higher management have not anticipated this decreased productivity then team chose to redouble its efforts when it occurred.

If more than one team is adopting agile methodology then overzealous team members can create negative impact on the others team as well. Decision which has been taken in hurry would not be correct and team might fail on agile methodology which created really bad impact on other teams who are in process of adoption this methodology.

Careful planning with discipline is necessary to adopt any new methodology some developer might resist the change and try to create negative environment in the team. It is responsibility of the scrum master to connivance them and show the correct path. Training for full team is very much necessary before starting the agile methodology.

**Requirement:** Product owner must know the agile methodology and take the responsibility of creating back-log priority, versioning it. In the estimation of the any item full team should participate. Requirement should not be ambiguous and quality of the requirement should be good. Agile methodology should accommodate the requirement even late in the development but thorough analysis of the requirement should be done and then only it should be included. It should be included in the next sprint not in the current one.

**Documentation requirements:** Business person should understand the agile methodology and write the requirement in the form of user stories. After years and years of extensive documentation of every step has been created in the traditional methods. While moving to a new method agile methodology with minimum Documentation requirements are a one of the greatest challenges. Every traditional project creating dozens of document such as project Plan, configuration plan, testing plan, SRS, STS, technical documents, user manual, etc. These a proper practice of agile software engineering techniques, and (c) a high-caliber team. These documents are very large and consume valuable time of team resources.

The documentation requirements were driven basically from upper management, ISO certificate requirements, CMMI requirement and the traditional development method like waterfall, spiral that is currently used.

Agile methodology development promises sufficient documentation of the projects, it did not seem very convincing to the upper management when they end up receiving few documents in comparison with the previous model of documentation. Many attempts were made to balance between the upper management requirement regarding documentation and between adopting Scrum method.

Agile methodology teams started to increase the number of documents required for documentation and started to customize scrum as much as possible to confirm with all the upper management requirements of documentation norms. This did not work very well and it created extra burden on the agile methodology teams.

#### IV. CONCLUSION

In this paper we have presented output of our literature survey and interaction with agile practitioners in the form of critical success factors for any organization to adopt agile practices. To conclude we identified that proper training must be given to each and every member of agile team, proper collaboration among the team members is also an important factor, effective executive buy in support is very essential for success factor, requirement gathering must be prepared as per the agile methodology specifications. We feel that by focusing on these identified critical success factors any software development organization successfully transforms their software development model from traditional to agile software development methodology.

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