A Novel Approach of Tailoring PMBOK activities that best suit Software Development Projects

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Abstract:

Project management is very critical for any project's success regardless of its category. Various Project management methodologies are available that provide set of guidelines and standards to effectively and efficiently manage projects in the organization. Managing software development projects has faced a lot of challenges while complying with these project management methodologies. This is mainly because project management methodologies like PMBOK does not provide specific guidelines for managing software development projects. This embarks the importance of project management tailoring activities in the software development firms, to tailor these project management methodologies according to their own need. This paper will propose six most essential tailoring activities for managing software development projects. These tailoring activities will be performed on the project management body of knowledge (PMBOK).

Keywords: PMBOK, Agile methodology, Kanban, Tailoring Activities, Software development projects

1. INTRODUCTION

Success of a project for an organization depends on how well they handle their critical success factors knowingly that they already have identified these factors. CSF's can only be identified if an organization has defined success properly within the organization [1]. Critical success factors of software project management can differ from standard project management success factors as these factors can vary from project to project according to the complexity and nature of the project. Hence CSF's identified below can be critical for the management of Software development projects.

- Specifications and requirements are well documented.
- Goals and objectives are well defined.
- Deadlines scheduled and estimated cost of the
- Project development should be realistic.
- Higher level management support.

According to [2], CSF's can be listed as people, process and technical factors and it is greatly noted that software projects do not fail due to technical aspects but usually people and process factors are involved in the failure. Hence it is essential that all major people and process CSF's are identified and well handled. Higher level management support is of utmost importance in the case of the software project as management of this project completely relies on how well the initial planning (goals and objectives) is defined and how well the management supports it. Deadlines scheduled and estimated cost of the project must be set according to the specification and requirements of the project. Hence all the above listed CSF's are of great importance to the software development project success.

- Effective customer involvement in project and agreement on project success.
- Selected Project management

methodology should be appropriate according to the current project.

- Experienced project team.
- Customer satisfaction.
- Resources are available and well managed.

Above CSF'S are supported by [3] according to them Customer involvement is of great importance in the project success as it can clearly bring a consensus of project team and customer on certain areas of the project and in the end, customer will be satisfied with the progress. Selecting a project management methodology is considered as the most important CSF as it covers all major areas of the project and if the project management methodology does not support the current project it can lead to failure of the project. Hence it is a must for any software firm to select an appropriate project management methodology for their project. Experienced staff can be a critical success factor for this project as if the staffs are well trained and have the capability to manage the project can resolve many hurdles during the project development. Apart from all other critical success factors, it is a must that resources are available and they are managed well according to the project demand.

2. PROBLEMS AND PROPOSED TAILORING

2.1. Work breakdown structure in PMBOK

Figure 1: Mapping of problem 1

Work breakdown structure is a very important part of project scope management as it defines the project into a smaller element of work. Software firm is using PMBOK approach and with the traditional work bread down structure there are some issues and challenges associated. Usually, people working on the project misinterpret project work breakdown structure with organizational work breakdown structure and this leads to great confusion in defining and planning of scope. According to PMI project management institute work breakdown is a tool that should cover the project

elements and should be logical [4]. Work breakdown structure does not define the processes that would be used for the project it is just the hierarchal structure to follow. Project scheduling is seen to have the biggest problem that project managers face while using work breakdown structure that is deliverable oriented this is because sometimes a centralized and standard work breakdown structure does not fit all the projects size and their scope and that is why often misread.

Software firm is using traditional WBS and it should be integrated with Kanban approach due to many reasons. Kanban method is pretty much compatible with any traditional process as it does not affect the normal flow of work and the tools that are being used. Kanban supports project managers to enhance efficiency and make it productive in terms of making team members well aware of what to do. According to Kanban approach the first process is to involve Kanban board master portfolio which is the level1 deliverable linked to level 2 deliverables processes and once deliverables of the second level are available, nested process elements can be added that is the level 3 deliverables [16]. This approach of Kanban levels in various Kanban boards helps project teams to respectively work on their level and hence reaching towards the real work.

2.2. Project Communication in PMBOK

Figure 2: Mapping of problem 2

In PMBOK approach project communication management is more focused towards informing rather than engaging. One of the major problems in Software firm current failure to address the project properly is not engaging the key stakeholders in work intervals of their software project. In Agile, stakeholders like users are more involved in the project through stage by stage active communication with the project team by their co-location. Agile also ensures better communication among team members through meetings that are routine stand-up [17]
Large and detail documentation for

communication management plan is a part of traditional project management practices but with scrum informal communication with scrum teams that focuses more on live communication is very effective.

For better information exchange daily scrum meetings are essential. Through cross functional teams in scrum, stakeholder's engagement is ensured hence managing stakeholders is not an essential part. Progress related information is made easier with this flow hence it ensures better distribution of information. Skype videos and other messaging tools that are online and instant are considered as very helpful for team members to communicate from different locations. Agile puts stress on frequent sharing of information with stakeholders related to lack of progress so that to get their buy-in in terms of getting relevant feedback from stakeholders. In the agile approach, communication is planned in a way that it puts more emphasis on face to face communication on daily basis, commitment and liability. Hence it can be said that agile is more focused towards light documentation with stress on face to face communication and regularly engaging all stakeholders. According to the investigation in IT projects in Cape Town, communication was among the most frequent problems that disturbed IT projects [18]. It is essential for Software firm to make sure that their stakeholders are up to date about OTOD project progress and get their feedback based on above method to ensure better communication distribution and feedback flow.

2.3. Shortcomings of lessons learned in PMBOK

Figure 3: Mapping of problem 3

Proper usage of lessons learned lacks in every type of organization due to its complex nature that takes into account technologies, process and people. The software firms are using PMBOK approach of lesson learned and PMBOK only provides a theoretical view of it. Managing lesson learned with proper tools and

techniques is not paid attention in PMBOK also with the lack of prescriptive approach and there is a gap of how to manage lesson learned, hence due to this reason there is a need to incorporate some other technology and tool to make proper use of it. It is noted that project managers and teams are not involved in this process as they are not motivated to share knowledge with each other. Web2.0 is a powerful technology that can combine PMBOK management aspect with process of the lesson learned, web 2.0 models, and project members to successfully achieve the real purpose of lessons learned in software development project. PMBOK approach is more likely to be said as project management 1.0 as it is more towards the operational side rather than strategic and agile approach. Power and flexibility given to the project team members and project managers can be said as project management 2.0 approaches. Incorporating web2.0 technology with lesson learned processes of PMBOK can make it flexible and agile [3,5-6]

Lesson learned involves processes like capture, storage, and share and disseminate. It is the responsibility of project managers to choose which tools of web 2.0 would be used to store lesson learned and best fit their capabilities. Lessons learned can be stored in the form of video or text, Wiki and online office suite can be used to store low structured lessons learned. Lesson learned in textual form supports Project managers to make a template to support retrieval of information. Capturing process involves four different sub categories ad each category or process can use different technologies. Passive collection can be done through wiki, blogs and videos, reactive collection can be based on video and VoIP, after action collection is enhanced by web2.0 collaborative methods like online office suite as this enables project team to capture lessons during the project phase. Proactive collection can be done through wiki, video and VoIP and this also allows team members to easily do editing through wiki. Share and verify can be done through online office suite as it is easier for project team members to share and verification online regardless of location. Disseminate process can be done through email, RSS, social book-marking and micro blogging, this allows project manager and project teams to broadcast using email and get notified about the lesson that is important to the project through RSS reference

2.4. Risk Management approach in PMBOK

Figure 4: Mapping problem 4

It is proven that risk management issues are one of the major reasons for the project failures for the organizations that follow PMBOK approach hence there is a need for tailoring in PMBOK approach to make it fit for different projects as standardized approach sometimes does not fit every project size and scope [13]. Hence for software project of any firm requires an approach like scrum to be integrated with current PMBOK approach to mitigate risks and do efficient risk management as scrum and PMBOK standalone cannot be a suitable approach to do risk management.

In scrum risks are highlighted in sprint planning meeting, such risks are linked with software aspects that will be a part of development in future sprint. Prioritization technique of risk stories is used to identify which risk story would be first selected and developed. Development team is responsible for examination of risks that are related to development. Mitigation activity, financial factor, risk exposure and its frequently occurring risks are the key attributes of risk that would be used. The weekly status meeting involves feedback of recent sprint tasks and project manage is responsible for leading it. Involvement of personals related to risk mitigation process can provide feedback for the important risks. Risk burn down chart is a good technique for going through the sprint tasks. Project owners are given report of project progress in sprint review meeting. Risks related to development of the current module must be removed before initiating the sprint review meeting. In some cases, if few risks are not removed and new risks are also highlighted than they must be documented and should be presented in the sprint review meeting. Project managers notify project owners with the progress using highlight report in scrum [14]. According to a model proposed that combines

PMBOK and Scrum approach includes activities like Risk board and risk notes (a risk note template based on sticky notes of two colors red and yellow) red sticky note is the risk identified and yellow sticky notes refers to the solutions. Checklist is used to highlight components of high risk. Also, some activities related to process are planning and identification, examination and response to risk also after that approval and monitoring of risk is done [15].

2.5. Project execution in PMBOK

Figure 5: Mapping of problem 5

PMBOK talks very little about how to actually execute any work. It focuses only on what to execute rather than provide in-depth detail of how to do it. In Software firm case of developing a software project requires in-depth understanding of how to execute each process because each process has its own credibility and complexity in the project. In software firm case it is noted that process execution lacks in planning and understanding as the current traditional project management methodology they are using does not provide enough detail of how to execute the work. It is essential for software development projects to understand and efficiently employ the execution of processes.

Iterative development refers to developing a system in iterations to overcome issues and problems. This iterative approach enables project team and project managers to quickly remit risks that are technical by considering each of the iteration separately rather than waiting for the phase of integration at the end to identify problems and at that time very less time will be left for resolving it. The iterative approach has a great advantage over the traditional approach that is linear and single phased, it gives a clear view of progress, a better understanding of learning outcomes and benefits are realized earlier using interval releases in the project. Team empowerment is another aspect of agile approach that is not covered by traditional project management

methodology. Software projects are not suited for top down approach of traditional methodologies as it becomes very difficult to allocate work based on the scope and has dependencies cannot be predicted. This way managing developers or team members through deploying respective tasks becomes very difficult and fails sometimes. So, it is better to empower teams by allowing them to be responsible of respective goals through a better understanding of major goal. In simple words allowing team members to engage in planning phase with business officers and hence for that iteration they choose and develop according to the best possible fit. Hence progress can be seen through features that are completed but dependencies solutions management is cover by the team as they are responsible for it. Meaningful metrics usage poses a great influence in software projects as a measurement of tools and processes is of great value. Tracking of metrics which are not directly relevant to the actual project goal is very important as metrics like increased lines of code can create complexity in the project and maintaining it would be difficult as well. Also, increasing working hours would result in more defects. Hence metrics that are relevant to the actual goal should be measured as a primary source. Hence that is why agile project management involves metrics like project time remaining and features delivered for measuring [12].

Software firm project manager and business officials should consider all of these agile features as an important aspect to make sure that the execution of processes is done efficiently considering all the discussed factors.

2.6. Quality Management issue in PMBOK

Figure 6: Mapping of problem 6

It is greatly noted that PMBOK puts stress on what processes can be used but does not specify what tools and techniques can be used in those processes hence PMBOK approach says that project quality assurance should be done and is part of project quality management but does not specify how to perform project quality

assurance [10]. Hence there is a need for agile techniques that are more focused on software quality assurance and best fits software projects as it is a software development project. Quality assurance in agile enables project managers and team members to quickly respond to customer demand of changes [11].

Agile approach combines QA and development aspects as shown in the figure below to enhance the time factor of processes as in software project case timely completion is the most important part and this can be achieved using this tailoring method.

Figure 7: Agile methods life cycle

Furthermore, agile quality assurance involves practices and they are widely used in software industry for software development projects. Requirements gathering and validation practice involve customer engagement and that is a part of validation process. Furthermore, it

identifies what can be done and is the right thing done. It involves practices such as demonstration of software, combined application development, joint planning meeting, on-site customer and prototyping. Verification practices are used to check whether the developed module is according to the specifications or not. Practices included automated acceptance testing, daily builds with testing, general testing, inspections, pair programming, test-driven development [12].

3. DETAILED DISCUSSION ON TWO MOST CRITICAL ACTIVITIES

3.1. Selection procedure of two most critical activities

Survey form is used to get feedback from five different experts. Each problem is rated according to its criticality based on the expert knowledge about software project management.

Six tailoring activities that were performed were related to the following areas:

(Rate these problems out of 5,

1 being less critical

2 being slightly critical

3 being moderately critical

4 being critical

5 being highly critical)

Work breakdown structure- _____

Reason if any: _____

Project communication management - _____

Reason if any: _____

Execution of processes- _____

Reason if any: _____

Lessons learned - _____

Reason if any: _____

Project Quality management- Improve Quality assurance- _____

Reason if any: _____

Risk management Approach - _____

Reason if any: _____

Figure 8: Selection procedure

Results of the survey form are calculated based of the scale of rating each expert gave to each problem. Scale is pretty much clear in the diagram above and all the required criteria is mentioned clearly. According to the rating by 5 different experts, the result is summarized below, points for each problem is calculated based on the cumulative score given by all the experts.

- Work breakdown structure [21]
- Project communication management [13]
- Execution of processes [10]
- Lessons learned [20]
- Project quality management [15]
- Risk management approach [22]

Based on the results it can be seen that the work breakdown structure and risk management approach is considered as the most critical problem for the current software firm case hence they need to be addressed in detail.

3.2. Risk management approach of PMBOK

Scrum master role plays a key role in process of identifying and managing risks. It is of great importance that scrum master should possess all the major expertise required for the risk management processes. Companies must make sure that they invest in a handsome way for the organization of project teams and their communication. Scrum master should effectively manage and guide the project team as risk management approach requires commitment from the team and the project manager [6].

Product backlog can be used for the identification of the risks. It highlights the risk that can affect the project during the development phase. Risk register is used to note down this activity based on the outcomes of the risk identification. Project team does this practice in iterations to note down everything that is relevant and important for the risk identification process. Product backlog risk identification process examines every risk according to the previously noted experiences based on lessons learned, project functional case and knowledge-based experiences. Risk register is contained as a simple document with to the point information as excessive details might create confusion in its management. Revised product backlog, Risk assessment charts, planning of risks response and risk monitoring and controlling are performed once the risks are identified according to the above-mentioned criteria and practice [29].

properties like visualized workflow, Feedback mechanism, improvement chances and WIP.

4. JUSTIFICATION AND IMPORTANCE OF TAILORING ACTIVITIES

It is very important that tailored methodology much fit the size, schedule and complexity of the project, must also adhere to the organizational environment and the industry to which the project fits. Such as Projects that are IT based are more towards tailoring that is based on agile methods while projects of building construction follow waterfall methodology. Tailored methodology can bring many benefits in terms of restructuring project to save it from failure, focusing more on customer engagement, adopting to changes and documenting accordingly and defining team roles in an efficient way [24].

OLD (<i>Espoused theory, explicit</i>)	NEW (<i>Theory-in-use, tacit</i>)
One best way	Tailoring AND One best way
Objective analysis	Subjective judgment AND Objective analysis

Figure 10: Ashby's Law of Requisite Variety [20]

According to a study by Nasa, the above-mentioned law states that an organization needs to increase its repertoire of response to adapt to the changes that are required. Project performance can be controlled only if there is feedback system and project managers are ready to adapt to changes in the processes. Organizations need to improve and enhance their response repertoire to adapt to the flexible processes. It is highly noted that managers and team member will only adopt to the changes if they are working in an environment that supports the flexible and adaptive context. Hence with strict standards of project management it is essential to include flexible and informal processes with it for the success of the project [20].

The tailoring activities proposed to Software development firms very well suits their current Software development project as it is a software development project and all the major

software development aspects and processes are covered. Methodologies, tools and technology selected for tailoring software project management methodology very well fits in with the size and complexity of the project. Keeping in mind that project needs fast recovery from failure, time factor has been covered in detail and appropriate tailoring activities are selected. Furthermore, this tailored methodology does not fit with all the projects that would be undertaken by Software firm as each project has its own size, complexity and nature and it might be possible that this methodology does not support any other project and Firms needs tailoring to this or either develop a new methodology.

5. CONCLUSION

Agile methodologies are very well known in software development projects due to the customer involvement factor and timely delivery of the modules based of short development life cycle. Agile approach focuses more towards customer needs which is also the part of its various methods like scrum and extreme programming. Major concept is linked with various principles and values that can be followed by a method to be included in agile on Software firm' case of software development project, stakeholder engagement in the project is of great importance and is also one of the CSFs hence agile approach is quite suitable for this project to cater to this aspect. Primary focus of agile methods is to manage software development processes in an effective way and develop a software that is defects free. Overall effectiveness of software development process means that for a specific situation in the development phase of the software, given requirements might change and adopted accordingly [9].

Larger organizations seem to have difficult in adopting agile methods due to its project and team's dependencies which require detailed and large amount of documentation which is not considered as agile approach. For example, human resource department has specified roles of each individual in the project and that usually does not change but in agile approach the role of individuals might change based on the changed requirements or demand. Agile is more centered towards short term project planning while in large organizations and projects it is quite often that management has long term planning for the projects and they

do not want to change their way of working. Furthermore, it is of utmost importance in the aspect of business and stakeholder relationship that planning should be short term based on feedbacks to get stakeholders buy in [7]. In case of software development project failure majority of the issues encountered were due to the standard project management methodology they were strictly following and according to the tailoring proposed in this paper agile suits most of the major areas, such as risk management approach, communication management and quality management. Hence agile methods are pretty much suitable for the Software development project based on its approaches discussed above.

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