Process improvement, APIM and GQM

Software quality management-Assignment 2

Akshay Kumar Jilla
9508109015
akji16@student.bth.se

***Abstract*—This document is about the personal experiences of the author in various software engineering development projects. The hindrances in the project process are identified. The improvements are explained using APIM model and GQM+ strategies. Jacobs tools recommended for these projects are also addressed.**

Keywords—APIM model; GQM+ strategies

I. INTRODUCTION

Every software that is developed includes a development process. The development process defines the way how things are to be done for successful completion of the projects. Not all projects have the same process. Software process improvement is useful to avoid risks and enhance the customer satisfaction and quality of the project. The Improvement of software process must be properly accustomed by the software development team from the previous development process for smooth flow of the process and avoid conflicts. From the many process improvement strategies, APIM and GQM+ strategies are addressed in this document as a part of our assignment.

This particular document describes the process of three different software development projects that the author experienced before. The improvements and the possible hindrances in those projects are explained in detail. The process improvement strategies such as APIM model and GQM+ strategies have been studied in detail and are applied to the author's experiences in order to perform the improvements. The similarities and the differences between the two strategies are also addressed. The tools recommended by Jacobs for these types of projects are also linked to the experiences of the author.

II. PREVIOUS EXPIRENCES IN SOFTWARE PROJECTS

Project A (Development of Battleship game):

The aim of the project is to develop a game called "Battleship" using python language as required by the customer. This is a simple game in which the system generates random digits which must be guessed by the user. The author was part of this project during his internship time in a startup company. The project was developed using waterfall model and should be completed in a time span of 45 days which was the major constraint. The project development team consisted of a cross-functional team of six members in which two members are developers, two members are designers and two members are testers. The members of the team performed the design and development phases without any trouble. The problem raised in the backend while connecting it to the database. The testing was performed and there were some bugs initially which were fixed in the later stages.

Improvements:

The development methodology might me improved. After the development of the project, team thought that the User Interface(UI) might have been much better. Even though the team had some experience in coding, all the members were interns which lacked previous project experience.

Hindrances:

The possible hindrances for this project might be:

- Lack of proper planning.
- Lack of commitment and proper-decision making of the team members.

Project B (Development of an airline ticket reservation system):

This project was conducted as a part of a course in the master's degree program of the author. The main aim of the project was to develop an airline ticket reservation system which consists of less development cost and cheaper fights than the existing websites. The team of six members were allotted for performing the task and each member was given a time constraint of 150 hours excluding the weekends. Roles and responsibilities for the members were assigned based on the skills of the individuals. The effort estimation was performed using planning poker. The software development methodology used was agile development methodology with Scrum as the software development life cycle. The whole project was divided into two sprints which lasted for about four weeks each. The communication was perfect and the development was performed as scheduled.

Improvements:

The final product was not delivered as expected as it has some bugs. We thought of adding of new feature like rating for the flight which would help the passengers in choosing better flights for improved quality. Due to the time constraint, the feature was not included.

Hindrances:

- The team consisted of members from different countries which raised to cultural and communication problem.
- The estimation for the project was done in an improper way due to which we had to adjust the period in sprints.
- There was no budget allocated for the project due to which we had to use open source tools for testing.
- Deviations in the project plan due to various reasons.

Project C (Parallelization of page ranking algorithm using MPI's):

This project was conducted as a part of the author's bachelor degree program. The project was assigned with a team of four members using waterfall model as the development model. The main aim of the project is to prioritize and retrieve the pages in the search engine using an algorithm on MPI. For performing this project, we have implemented the parallel k-means clustering algorithm by using MPI on parallel clusters. Development of this algorithm on MPIs would also helped us to determine its efficiency when compared to traditional CPU or GPU. Additional roles and responsibilities were assigned to single team member as the team size was very small. Based on the skills and experiences of the team members two front-end developers, two back-end developers and two testers were assigned to perform the whole project. The duration for completion of the project was two months. The testing was performed with open source tools and the results were presented.

Improvements:

The product was developed with an appropriate algorithm for page ranking. We were unable to run the task using MPI. The main reason was that all the members were in the initial bachelor level and no member had any initial project experience.

Hindrances:

The hindrances that occurred in the project while development are:

- The capacity of the team was very less as only four members were involved in performing a huge task.
- Inappropriate process methodology used.
- No previous experience of the team members.
- Additional overload on the team for testing as less number of people were assigned for the project.
- All the tools used by the team were open source tools as no budget was allocated for the project.

III. USING APIM STRATEGIES FOR IMPROVING THE PROCESS

From the three experiences that were mentioned earlier, two projects i.e. Project B (Development of an airline ticket reservation system) and Project C (Parallelization of page ranking algorithm using MPI's) are chosen for improving using APIM strategies [1]. The major hindrances described in these projects are:

- Communication and cultural differences due to different person backgrounds.
- Deviations in the project plan.
- Constraint of no budget allocation.
- Improper effort estimation.

- Lack of experience of employees.
- Inappropriate selection of software development methodology.
- Additional Overload on employees

The different activities that are part of APIM strategies which help to overcome the hindrances and improve the process are described below:

Premature phase:

The different activities that are a part of this phase are:

a) Launch:
- Establishing the goals and objectives for the process improvement in this initial phase.
- Regular meeting with executive management for effective collaboration and communication.
- Determining the appropriate development model that is best suited for the current project.
- Proper estimation of allocated budget and resources.
- Initializing a kick-off meeting with executive management and staff members to discuss and decide about the process improvement strategies.

b) Planning:

Project B in the above experiences doesn't require any planning as it was developed using agile development model which includes planning internally. For project C, the recommendations are:
- The planning process must be simple and iterative as we cannot anticipate the future circumstances.
- Establishing short-term and long-term achievable goals for the development process.
- Preparing a solid communication plan for regular communication between the members of the team and management to avoid communication problems.
- Minimal documentation in accordance with data management planning.
- Risk management plan must be established to avoid and monitor risks.

Maturity phase:

The various activities which are part of maturity phase are:

a) Awareness:
- Usage of SWOT analysis for analyzing the project and team's current status.
- Analysis of the weakness and strengths of the project in advance for attaining a final quality output.

b) Triage:
- Prioritization of improvements in order to figure out which improvements to be addressed first.
- This helps for faster and efficient improvement process.

c) Resolution:
- Usage of tools and techniques such as brainstorming, training, SWOT analysis for filling the gaps in the development process helps reducing the risks.
- Establishing Process Action Teams (PAT) for reporting the status and addressing the risks might help reducing the deviations in the plan.

d) Training:
- In project B, SCRUM model is used which ensures that training and development are performed in parallel.
- For project C, providing simple training for newly recruited employees by mentoring, organizing workshop helps them in gaining some knowledge.
- Dividing the training process and based on the feedback, evaluating and improving the training process are encouraged.

e) Deployment:
- The criteria to be met for implementing the improvements is established and the projects which meet the criteria are selected.
- The steps that are a part of piloting include setting pilot schedule, mentoring pilot staff, implementing the process, documenting results and finally submit for final assessment.

f) Trial:
- The improvements are evaluated and approved if it is successful.
- The disapproved processes are sent back for re-piloting.
- Implementing the approved processes and further verifying that the organizations are totally adapted to the new process helps running the project cleanly.

Post-maturity phase:

a) Appraise:

- Estimating the process appraisal using formal assessments like ISO standards, CMMI levels, PMBOK etc.
- External and internal assessments can also be done using audits, reviews etc.

b) Improve:

- The progress of individuals and the project as a whole are documented and recorded for future purposes.

IV. USING GQM+ STRATEGIES TO IMPROVE THE PROCESS

The project A (Development of Battleship game) have been chosen for implementing GQM+ strategies for improving the process [2]. The hindrances mentioned in this project are:

- Lack of proper planning.
- Lack of commitment and proper-decision making of the team members.

The various activities that are part of the strategy and help improving the process are:

a) Initialize:

- This is the starting part of applying the strategy where the management holds a meeting where it defines the organizational scope and planning of the application of the GQM+ strategies.
- Training is provided to the employees on the strategies to accustom to the new improvement process.

b) Characterize Environment:

- Refinement of the strategies based on the scope of the organization after its application and specifying the characteristics of the application environment.
- The various factors that should be taken into consideration in this project are:
  - Size of the organization: small
  - Type of process based on the product: waterfall model
  - Boundaries: Limited time, Limited budget
  - Working environment: not so friendly.

c) Define goals, strategies, and measurement:

- During this process the existing assets such as previous goals and objectives, currently collected data, measurement procedures are identified.
- Irrelevant assets are removed and a GQM+ strategies grid is established.
- The GQM+ strategies grid is established taking into consideration of organizational goals, strategic decisions, refining the strategies and defining the GQM graphs.
- The grid can be reviewed and adjusted in the future.

d) Plan Grid implementation:

- In this phase the plans for implementing the selected strategies are designed.
- Data collection is performed and the current practices are adjusted with the new practices.
- Training is given to the individuals on the new strategies so that they get used to it.

e) Execute plans:

- The selected strategies are implemented in the process and the performance of the strategies are analyzed.
- Feedback based upon learning taken from the members is recorded for analyzing the outputs.
- Measurable data is collected for validating, analyzing, visualizing and the results are interpreted.

f) Analyze outcomes:

- The strategies that are implemented are analyzed to know the role of the strategies in the process improvement.
- Potential improvements are identified for further GQM+ strategies processes.

g) Package improvements:

- Based on the experience and feedback from the implementation of the strategies and plans in the previous iteration, revision of the GQM strategy grid is performed for next iteration.
- Experiences from the previous iterations are always recorded and preserved.

V. SIMILARITIES AND DIFFERENCES IN BOTH THE STRATEGIES

Similarities:

- Both the strategies are used for process improvement and are iterative in nature.
- Both the models involve training for individuals. In APIM the feedback from the individuals in taken into consideration for improving the process.
- Both the strategies include planning process initially which helps to monitor the progress during the course of time.
- Feedback is taken after implementing both the strategies which is helpful in adjusting and improving them in the upcoming iterations.
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Differences:

- The Agile Practice Implementation Model (APIM) is well suited for agile models whereas the GQM+ strategies are suitable for traditional models like waterfall and incremental model.
- The assessment in APIM is done using audits and self-assessment which is not followed in GQM strategies.
- The phases in APIM model is more concrete and specific and the phases followed in GQM are comparatively less concrete.
- APIM mainly aims on the maturity of the phase which is not present in GQM strategies.

VI. TOOLS RECOMMEDDED BY JACOBS FOR THESE PROJECTS

- ***Work breakdown structure (WBS):***
  The work breakdown structure helps to divide the work into feasible sub-parts which is useful for project management, effort estimation and resource allocation. The WBS was used as a part of project B where the features in the website are divided into minor sub-divisions.

- ***Gantt charts:***
  The Gantt chart is the pictorial representation of the various activities and milestones in the due course of the project. This helps us to analyze the estimation of the duration of the project. The Gantt chart was used in projects A and B mentioned above to keep track of the schedule of activities performed during the process.

- ***Initial kick-off meetings:***
  The kick-off meetings are organized before the actual development process starts. In this project the project managers along with their team members discuss about the project management plan, budget allocation, effort estimation etc. This meeting was initialized during the course of all the three projects mentioned earlier as it is one of the mandatory task to be performed before starting the actual process.

- ***Feature checklist or APIM checklist***
  The feature checklist helps to keep record of the tasks that are completed and yet to be completed which is one of the useful criteria while risk monitoring. The feature checklist was used in the project B and project C.

- ***Audit assessment:***
  An audit is an inspection performed by an independent body in an organization on the development team to assess whether the tasks are being completed on schedule. This helps to reduce the deviations in the project and is useful to complete the project on time.

VII. REFERENCES

[1] Jacobs, Deb. "*Accelerating process improvement using agile techniques"*. CRC Press, 2005.

[2] Basili, Victor, et al." *Aligning Organizations through Measurement: The GQM+ Strategies Approach"*. springer, 2014.