Unit 14 Project Closure

Structure:

14.1 Introduction

In the previous unit, we have discussed the importance of software reengineering. Once the project is completed it should be closed properly. This unit will take you to the steps involved in closing the project.

The software has been delivered and installed successfully. After working long hours and weekends for many months on this project, the project manager and his team will have a sign of relief that the project is finished. Now the question is, did the project manager learn any lessons from this project? Will he and the team members be able to avoid repeating the problems they got into in this project? If the project ends now, it is likely that the story will be repeated in another project, perhaps with minor improvements.

For the project manager, the team, and the organization, the project does not end until a postmortem has been done to uncover what went wrong and why and what worked and why. This analysis will enable the project manager and the team members to cut out key lessons on project execution. In addition to helping the team members in their future projects, these lessons will also help other projects to improve their execution. A project closure analysis, or postmortem analysis, is a golden opportunity for process improvement that should not be missed.

Indeed, this exercise is considered a best practice of software engineering. One step in the quality improvement paradigm of the experience factory is to analyze the data at the end of each project to evaluate current practices, determine problems, and so on. But despite its benefits, a postmortem analysis is not a "standard" activity.

This unit describes the contents of a project closure analysis report and gives the closure report of the ACIC case study.

Objectives:

After studying this unit, you should be able to:

- explain the necessary steps for project closure analysis
- prepare a report on project closure analysis
- analyze a sample project closure analysis report

14.2 Project Closure Analysis

Project closure analysis is the key to learning from the past so as to provide future improvements. To achieve this goal, it must be done carefully in an atmosphere of safety so that lessons can be captured and used to improve the process and future projects. Before we describe the details of the closure analysis report, we briefly discuss the role of closure analysis and its implementation.

The Role of Closure Analysis

The objective of a postmortem or closure analysis is "to determine what went right, what went wrong, what worked, what did not, and how it could be made better the next time”. Relevant information must be collected from the project, primarily for use by future projects. That is, the purpose of having an identified completion analysis activity, rather than simply saying, "The project is done," is not to help this project but rather to improve the organization by leveraging the lessons learned. This type of learning can be supported effectively by analysis of data from completed projects. This analysis is also needed to understand the performance of the process on this project, which in turn is needed to determine the process capability.

As noted earlier, the data obtained during the closure analysis are used to populate the process database (PDB). The data from the PDB can be used directly by subsequent projects for planning purposes. This information is also used in computing the process capability, which is used by projects in planning and for analyzing trends. Figure 14.1 illustrates the role of closure analysis.

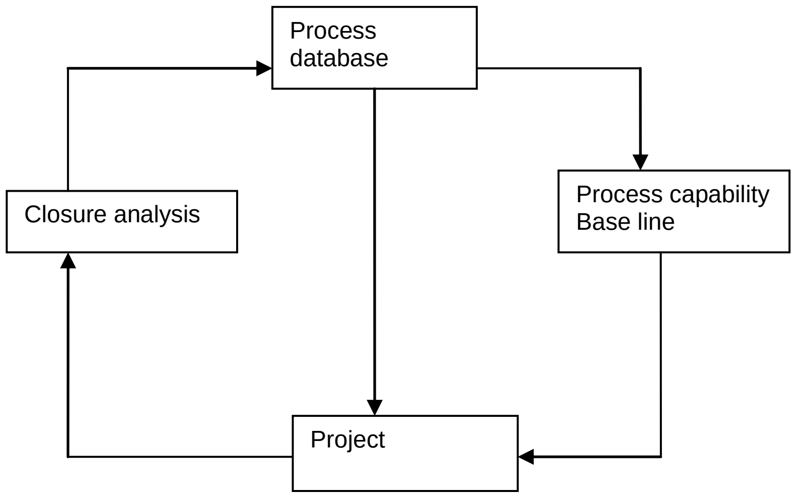

Fig. 14.1: The role of closure analysis

The amount of raw data collected in a project can be quite large. For example, a project involving five people and lasting for 25 weeks will have 125 entries for weekly effort, data for about 250 defects (assuming about 0.05 defects injected per person-hour), data on many change requests, various outputs, and so on. Clearly, these data will be of limited use unless they are analyzed and presented within a proper framework and at a suitable level of abstraction. Closure analysis aims to accomplish this goal.

After data analysis and extraction of all lessons learned from the analyses, the results should be packaged so that they can be used by others (packaging is the last step in the quality improvement paradigm). Furthermore, to leverage this information, project processes must be constructed so that their execution requires the effective use of data. It can be argued, however, that even if others do not learn from the packaged information, the project personnel will have consolidated their experience and will carry the lessons learned from the analysis into future projects. In other words, a closure analysis is useful even if others do not directly gain from it.

Performing Closure Analysis

In some of the CMM level 5 companies, the project manager carries out the closure analysis with help from the quality adviser associated with the project. A template for the analysis report has been defined. The person carrying out the closure analysis must fill out this template properly, using mostly the metrics data, thereby keeping the focus on objective information.

As discussed earlier, the effort data are available from the weekly activity report database. The defect data can be gathered from the defect control system. Size data are obtained from the project. Planning data appear in the project management plan. These data constitute the main information needed for metrics analysis.

The data are first analyzed by the quality adviser, who develops an initial interpretation of the results. A meeting is then held among the quality adviser, the project leader, and other project members. The initial report serves as the basis of discussion, and further points and observations from the meeting are also noted. This meeting yields the basis of the final closure analysis report.

The final report is submitted to the business manager of the project and is shared among the project team members. The report is also entered in the PDB, making it available for future projects and analyses.

Self Assessment Questions

1. Project closure analysis is the key to learning from the past so as to provide future improvements. (True / False)
2. The data obtained during the closure analysis are used to populate the _______________.
3. The final project closure analysis report is submitted to the _____________ of the project. (Pick right option)
   a) Business Manager
   b) Project Manager
   c) System Manager
   d) Database Manager

14.3 Case Study 1: Infosys Project Closure Analysis Report

This section briefly discusses the major elements in an Infosys project closure analysis report; later, we present the closure report of the ACIC project. The contents of this analysis report form a superset of the data that are put in the PDB. The PDB contains only those metrics data that are needed often by projects and whose use is required by the current processes. The analysis report, however, may capture other data that might shed light on process performance or help to better explain the process.

General and Process-Related Information: The closure report first gives general information about the project, the overall productivity achieved and quality delivered, the process used and process deviations, the estimated and actual start and end dates, the tools used, and so on. This section might also include a brief description of the project's experience with tools (detailed "experience reports" are put into the Body of Knowledge (BOK) system). The information about tools can be used by other projects to decide whether use of the tool is warranted. It can also be examined to identify tools that have good advantages and to propagate their use throughout the rest of the organization.

Risk Management: The risk management section gives the risks initially anticipated for the project along with the risk mitigation steps planned. In addition, this section lists the top risks as viewed in the post-project analysis (they are the real risks for the project). This information can be used by later projects and can be used to update risk management guidelines. Notes may also be provided on the effectiveness of the mitigation steps employed.

Size: Many projects use the bottom-up method for estimation. In this method, the size of the software is estimated in terms of the number of simple, medium, or complex modules. Hence, this size is captured along with the criteria used for classification (different projects may use different criteria). Data on both the estimated size and the actual size are included.

For normalization purposes, the productivity of a project is measured in terms of function points (FP) per person-month. Although FP can be counted by studying the functionality of the system, at closure time it is computed from the measured size in lines of code (LOC). If multiple languages are used, we simply add the sizes (in FP) of the modules in different languages.

Causal Analysis: When the project is finished, the performance of the overall process on this project is known. If the performance is outside the range given in the capability baseline, there is a good chance that the variability has an assignable cause. Causal analysis involves looking at large variations and then identifying their causes, generally through discussion and brainstorming.

Effort: The closure analysis report also contains the total estimated effort and actual effort in person-hours. The total estimated effort is obtained from the management plan. The total actual effort is the sum of the total effort reported in all reports submitted by the project members, including the project leader. If the deviation between the actual and the estimated values is large, reasons for this variation are recorded,

For each of the major steps in the process, the total actual effort and estimated effort for the stage are captured, too. This information can be useful in planning, and it is a key input in forming the PCB. The distribution of effort in the various phases can then be computed and recorded. The separation of effort between task, review, and rework aids in identifying the of productivity improvement.

The cost of quality for the project is also computed. It measures the cost of all ties that directly contributed to achieving quality. The cost of quality can be in many ways; here it is defined as the percentage of the total effort spent in review, testing, rework to remove defects, and project-specific training.

Defects: The defects section of the closure analysis report contains a summary of the defects found during the project. The defects can be analyzed with respect to severity (percentage of defects that were major, minor, or cosmetic), stage detected (percentage of total detected defects detected by which activity), stage injected (which activity introduced what percentage of total defects), and so on. Injection rates and defect distribution are also determined.

The defect removal efficiency of a defect removal task is defined as the percentage of total defects that existed at the time of execution of the task that are defected by the execution of the task. This metric is useful for determining which quality activities need improvement. The closure report gives the defect removal efficiency of the major quality control tasks, as well as the overall defect removal efficiency of the process. Other analyses of defect data may also be included. Sometimes, a separate analysis of the review data may be performed. The estimated versus actual defect levels are also analyzed.

Process Assets: In addition to the metrics data, other project artifacts are potentially useful for future projects. The potential entries to the BOK are also identified during closure, although they are submitted later.

Self Assessment Questions

4. At Infosys, many projects use the top-down method for estimation. (True / False)
5. For normalization purposes, the productivity of a project is measured in terms of _______________ per person-month.

14.4 Case Study 2: ACIC Project Closure Analysis Report

This section presents the closure analysis report of the ACIC project. First, the report gives some general information about the project. The performance summary that follows shows that the project had an effort overrun of about 19% caused by two major change requests. It also gives the planned versus actual data for team size, start and end dates, quality, productivity, cost of quality, defect injection rate, and defect removal efficiency. In almost all these parameters, the actual performance was very close to the estimated. The actual defect injection rate is about 26% lower than estimated, largely because of the defect prevention activities.

The report gives an overview of the process tailoring done in the project and specifies the internal and external tools that were used. For risk management, the report discusses the risks that were originally identified as well as the real risks that the project leader feels existed for the project. As you can see, these are not the same; a new risk – conversion to VAJ 3.0 – arose during the project. The notes on risk mitigation state that this risk was effectively managed by showing the impact of the change to the customer and then agreeing to postpone this conversion to a future version. For other risks, the notes assess the effectiveness of the risk mitigation strategies.

Sample Project Closure Analysis Report

1. General Information

Project Code	: Xxxxx
Life Cycle	: Development, Full life cycle
Business Domain	: Finance. Web-based application for managing accounts.
Project leader/Module Leader	: XXXXX

Business Manager : XXXXXXX
Software Quality Adviser : Xxxxx

2. Performance Summary

Performance Parameter	***Actual***	***Estimated***	***Deviation***	***Reasons for Deviation (If Large)***
Total Effort (person-days)	597	501	19%	Two major change requests that came.
Peak Team Size	9	9	0	N/A
Start Date	03 Apr 2000	03 Apr 2000	0	N/A
End Date	03 Nov 2000	30 Nov 2000	27 Days	Two major change requests consumed more than 5% of the effort.
Quality (number of defects delivered per FP)	0.002	0.0125		Quality improved because of defect prevention and use of incremental process.
Productivity	58	57	2%	N/A
Cost of quality	31.4%	33%	5%	N/A
Defect injection rate	0.022	0.03	-26%	Improved because of defect prevention.
Defect removal efficiency	97.4	97	Small	N/A

3. Process Details

- Rational Unified Process (RUP) was employed.
- Development and analysis were done iteratively. Three iterations for development and two for design and analysis were done.
- Requirement traceability was done through Requisite Pro tool.

4. Tools Used

- External Tools: VSS, VJA, Requisite Pro, MSP
- Internal Tools: BugsBunny, WAR

5. Risk Management

Risks identified at the start of the project:

Risk 1 Lack of support from database architect and database administrator of the customer

Risk 2 Improper use of RUP, as it is being used for the first time

Risk 3 Personnel attrition

Risk 4 Problems with working on customer's database over the link

Risks encountered during the project:

Risk 1 Impact of conversion to VAJ 3.0

Risk 2 Lack of support from database architect and database administrator of the customer

Risk 3 Improper use of RUP, as it is being used for the first time

Risk 4 Personnel attrition

Notes on Risk Mitigation

Risk I: Clearly articulating the risk helped in customer agreeing to postpone the conversion with proper budgeting of its impact.

Risk 2: Mitigation strategies of careful and advance planning and employing the on-site coordinator were effective.

Self Assessment Questions

6. Lack of support from database architect and database administrator of the customer is considered as a risk. (True / False)
7. RUP stands for _______________.

14.5 Summary

Let’s recapitulate important points discussed in this unit.

A project does not end with the delivery and installation of the software; before it is closed, it must be used for learning. Project closure analysis is one method to achieve this goal.

Following are some of the key takeaways from the Infosys approach to project closure

- Keep the project closure analysis metrics-based. Analyze the data to understand the performance of the project and the causes for any major deviations. These causes can serve as a source of improvement initiatives.

- The metrics analysis should report the final quality delivered, the productivity achieved, the distribution of effort, the distribution of defects, the defect removal efficiency of various quality activities, and the cost of quality.
- Collect reusable process assets such as plans, checklists, standards, and guidelines, and make them available for others.

With respect to the CMM, project closure is not a direct requirement of the KPAs dealing with project management. However, the closure report provides the data for the process database and process capability baseline, which are necessary to satisfy many of the requirements, of the Project Planning KPA and the Integrated Software Management KPA. They also aid in learning and recordkeeping, which are required at level 3.
(KPA = Key Process Areas)

14.6 Terminal Questions

1. What do you mean by Project Closure Analysis? Explain.
2. Bring out the key features of Infosys Project Closure Analysis Report.
3. What are the salient features of ACIC Project Closure Analysis Report?

14.7 Answers

Self Assessment Questions

1. True
2. Process Database (PDB)
3. a) Business Manager
4. False
5. Function Points (FP)
6. True
7. Rational Unified Process (RUP)

Terminal Questions

1. Project closure analysis is the key to learning from the past so as to provide future improvements. To achieve this goal, it must be done carefully in an atmosphere of safety so that lessons can be captured and used to improve the process and future projects. (Refer Section 14.2)

2. The contents of Infosys analysis report form a superset of the data that are put in the PDB. The PDB contains only those metrics data that are needed often by projects and whose use is required by the current processes. The analysis report, however, may capture other data that might shed light on process performance or help to better explain the process. (Refer Section 14.3)
3. The ACIC report gives some general information about the project. The performance summary that follows shows that the project had an effort overrun of about 19% caused by two major change requests. It also gives the planned versus actual data for team size, start and end dates, quality, productivity, cost of quality, defect injection rate, and defect removal efficiency. In almost all these parameters, the actual performance was very close to the estimated. The actual defect injection rate is about 26% lower than estimated, largely because of the defect prevention activities. (Refer Section 14.4)

Acknowledgements, References and Suggested Readings:

1. Carlo Ghezzi, "Fundamentals of Software Engineering", Second Edition, Pearson Education, 2003.
2. Roger S. Pressman, "Software Engineering", Fifth Edition, Tata McGraw Hill.
3. Schwalbe, Kathy, "Information Technology Project Management", Second Edition, Course Technology, 2002.