BACHELOR OF COMPUTER APPLICATIONS

SEMESTER 6

DCA3245

SOFTWARE PROJECT MANAGEMENT

Unit 14

Project Closure

Table of Contents

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 proposed software has been developed, tested, 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? Were there any best practices that team would like to adapt to future projects? These points will be worth pondering so that team can improve upon its performance in the future projects.

For the project manager, the team, and the organization, the project will not be over until the postmortem report has been generated. The postmortem report of the software project is done to determine mainly what went wrong and what could have been carried out in a better way. This analysis will enable the project manager and the team members to record key learning of the project. In addition to helping the team members in their future projects, these lessons will also help other projects of the organization 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.

1.1 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*

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

This type of learning can be supported effectively by analysis of data 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. 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). In some organizations the PDB is maintained like a repository which would act as knowledge base for future projects of the company. 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.

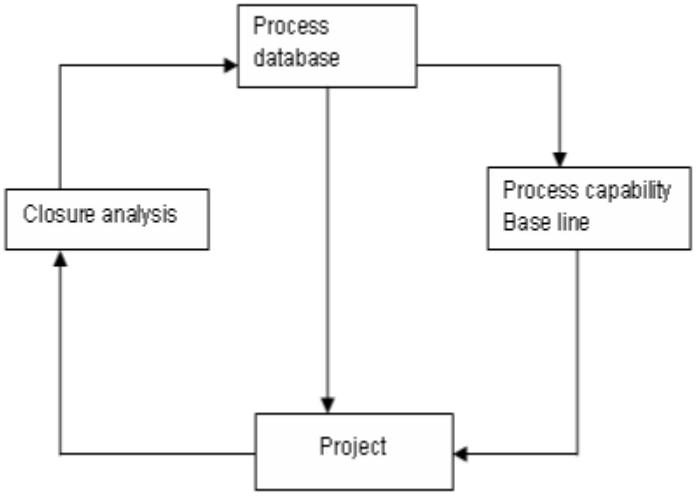

Fig. 14.1: The role of closure analysis

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.

Steps for closing a project:

- Formally transfer all deliverables.
- Confirm project completion
- Review all contracts and documentation
- Release resources
- Conduct a post-mortem
- Archive documentation

1. **Formally transfer all deliverables:** Formally transferring deliverables is a crucial step in the project closure process. It ensures that the client or relevant stakeholders have full ownership and control of the project outcomes. Here's how you can formally transfer deliverables: If the customer signs off, the project can be declared complete or Project Closure time

   The first step in closing out the project is to finalize and transfer the project deliverables to the client. Project plan must be studied in detail so as to identify all deliverables and ensure their completion and handed over to clients. Make a detailed inventory of everything you plan to do. Don't forget to include thorough explanations, specs, and supporting materials.

   Examine and Verify Outputs: Verify that all deliverables are up to par with the agreed upon criteria. Make sure they fit the description given by the client.

   Create an official document to hand over control of the deliverables to the client or other interested parties. Include the following in this record:

   - Specifics of the handed-over goods.
   - Client approval has been confirmed.
   - The transfer's prerequisites and/or circumstances.
   - Both parties' authorised representatives' signatures are required.
2. **Confirm Project Completion:** All stakeholders must agree that all parts of the project plan has been delivered, with official sign-offs from the project stakeholders.

   Project completion certificate is the next step. Self-declaration of closure is not sufficient. Each stake holder needs to agree on the project's completion before it can be formally closed. By missing this step, one may continue to receive charged for changes requests by the client.

   Approvals for the project deliverables are required to confirm the project's completion. Documentation of this step is a must as it provides the proof that the project closure was formally signed off

The project closing procedure isn't complete until the project's completion has been confirmed. It entails checking that everything that was supposed to be done on the project was actually done, from the activities to the tasks to the deliverables. Methods for Verifying Project Completion Go Over The Goals Of The Project Start by thinking back to why you started this endeavour and what you expected to achieve. This can be used as a standard against which to evaluate the project's success. Check the Results: Make that everything expected from the project has been completed and is of sufficient quality.

3. Review all contracts and documentation

The final phase of any project is the review of all contracts and paperwork. This guarantees that the project has met all contractual and legal requirements. Here's one way to go about solving this problem: Make a Checklist of Contracts and Related Paperwork:

Make sure you have a copy of every agreement, contract, and other legal document that pertains to this project. Contracts with suppliers and customers, agreements with clients, purchase orders, and legal correspondence are all examples. Collect All the Originals: Retrieve all signed agreements and supporting paperwork from the project's archive. Make sure you're using the most recent editions available. Check for Satisfaction of Contractual Duties: Go over every agreement and make sure everyone has met their end of the bargain. Everyone who has any stake in the project is included here, from the client to the vendors and contractors. Verify Acceptance of Deliverables: Make that the contract deliverables have been accepted by the client or relevant parties. Check out the Money Deals: Verify that all payments, invoices, and budget allocations have been made in a timely manner and in accordance with the terms of the contracts.

4. Release resources

- After delivering the deliverables and receiving formal sign-off from the customer, the project manager must hand over the resources to their respective departments so that they can be sourced for other projects

- Resources are released formally from the project, (like suppliers, contractors, team members, and any other partners.)
- They are informed about the end of the project, final payments are confirmed, and official release take place so that they are free to work on other projects
- The process of closing a project relies heavily on the release of resources. This phase requires the project's resources to be reallocated or demobilised in an orderly fashion. Here's how to free up resources efficiently:

Identify Resources to be released:

Compile a list of all resources, including team members, equipment, materials, and any other assets that were allocated to the project.

Notify Team Members in Advance:

Inform team members about the project's completion and their impending release. Provide them with clear instructions on their next assignments or tasks.

Coordinate Equipment and Material Return:

Arrange for the return or demobilization of any equipment, tools, or materials that were specifically procured or allocated for the project.

Conduct Exit Interviews (if applicable):

If appropriate, conduct exit interviews with team members to gather feedback on their experiences during the project. This can help in identifying areas for improvement in future projects.

5. **Conduct a post-mortem:**

   A project closure analysis or a post-mortem is one of the most valuable steps of the project closure process.The successes, failures, and challenges of the project are reviewed and opportunities identified for improvement. The project's performance is calculated in terms of cost, schedule, and quality.

A survey or a meeting is conducted with the project management team to get feedback on how the project went conducting a post-mortem, also known as a project retrospective, is a crucial step in the project closure process. It involves a thorough evaluation of the project's performance, outcomes, and processes. Here's how you can effectively conduct a post-mortem:

- Set the Stage:

  Schedule a meeting for the post-mortem session and invite relevant team members and stakeholders. Ensure that the meeting has a clear agenda and a designated facilitator.

- Create a Safe Environment:

  Establish an open and non-blaming atmosphere where team members feel comfortable sharing their thoughts, opinions, and feedback.

- Define Objectives:

  Clearly state the objectives of the post-mortem, which typically include identifying what went well, what didn't, and how to improve in future projects.

- Review Project Goals and Objectives:

  Begin by revisiting the initial project goals and objectives. This provides context for the discussion and allows for an assessment of goal attainment.You can improve your project management practises and the results you get from them by doing a thorough post-mortem.

6. Archive documentation

This can be a tedious, painstaking project finalization step, depending on the scope and complexity of your project. But try to think of it as your “project library”

Once project post-mortem is completed, documents can be finalized all documentation and indexed in the company archives for later reference.

Ensure to keep clear notes on the project's performance and improvement opportunities for easy reference.

These notes can be implemented on similar projects in the future. Documentation archiving is a vital part of finishing up a project. As a result, you can rest assured that you'll always have access to any documents, reports, or artefacts that pertain to your project. Here's how to properly store project records: Make a Single Location for Everything: Create a space (physical or virtual) where all project records will be kept indefinitely. The term "filing system" can refer to either a digital or physical repository for documents. Arrange Paperwork: Documents such project plans, reports, meeting minutes, contracts, and communications should be sorted and filed accordingly. Naming standards should be simple and easy to understand.

SELF-ASSESSMENT QUESTIONS - 1

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

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 - 2

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.

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

Table 14.1: 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 l: 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.

Casual Analysis:

The purpose of causal analysis, or casual analysis, is to establish and clarify the links between antecedent and consequent factors or occurrences. The purpose of this analysis is to identify the causes of a given result. If a change request has a major impact, discussion with the customer using a detailed impact analysis can be very helpful in setting the right expectations and doing a proper cost-benefit analysis (which may result in postponement of the change, as happened in this project). Specify the issue or result you intend to examine. This provides background for the subsequent explanations.

Defect prevention can substantially reduce the defect injection rate. In terms of effort also, defect prevention pays off handsomely; There were very low defect removal efficiencies of code reviews and unit testing. Collect all the information you can find that pertains to the issue at hand or the expected result. Quantitative data, qualitative observations, reports, interviews, and any other material gathered may be included here.In this project, the system/integration testing compensated for the poor performance of reviews and unit testing. Examine the possible reasons in light of the effect that has been seen. Look for obvious links between causes and effects. Understanding complex systems and making well-informed judgements about interventions or changes are greatly aided by the use of causal analysis. It aids in determining the origins of problems, which leads to more precise and fruitful approaches to fixing them.

Process Assets:

The term "process assets" is used to describe the various types of resources, tools, documentation, and expertise that a company amasses over time as a result of its project management efforts. These resources help the company maintain a high rate of project success and form the basis for efficient project management. A project does not end with the delivery and installation of the software; before it is closed, it must be used for learning

Project management plan, project schedule, configuration management plan, Java coding standards, code review checklist, integration plan review checklist, impact analysis checklist, causal analysis reports for defect prevention.

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

Project managers and teams can more effectively plan, carry out, and monitor their work thanks to the process assets they have access to. They help ensure uniformity across the company and promote ongoing development of project management techniques.Some of the example for process assets are as follows:

- Methodologies and process
- Templates and forms
- Historical data and lesson learned
- Knowledge repositories
- Software tools

SELF-ASSESSMENT QUESTIONS - 3

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

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 produc-tivity 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)

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?

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 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 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 4)

8. REFERENCES AND SUGGESTED READINGS:

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