
Abstract

This chapter provides an introduction to project management for traditional software engineering, and we discuss project estimation, project planning and scheduling, project monitoring and control, risk management, managing communication and change and managing project quality.

Keywords

Business case · Project planning · Estimation · Scheduling · Risk management · Project board · Project governance · Project reports · Project metrics · Project monitoring and control · Quality management · Prince 2 · PMP and PMBOK

2.1 Introduction

Software projects have a history of being delivered late or over budget, and software project management is concerned with the effective management of software projects to ensure the successful delivery of a high-quality product, on time and on budget, to the customer. *A project is a temporary group activity designed to accomplish a specific goal such as the delivery of a product to a customer. It has a clearly defined beginning and end in time.*

Project management involves good project planning and estimation; the management of resources; the management of issues and change requests that arise during the project; managing quality; managing risks; managing the budget; monitoring progress; taking appropriate action when progress deviates from expectations; communicating progress to the various stakeholders; and delivering a high-quality product to the customer. It involves the following:

- Defining the business case for the project,
- Defining the scope of the project and what it is to achieve,
- Estimation of the cost, effort and schedule,
- Determining the start and end dates for the project,
- Determining the resources required,
- Assigning resources to the various tasks and activities,
- Determining the project lifecycle and phases of the project,
- Staffing the project,
- Preparing the project plan,
- Scheduling the various tasks and activities in the schedule,
- Preparing the initial project schedule and key milestones,
- Obtaining approval for the project plan and schedule,
- Identifying and managing risks,
- Monitoring progress, budget, schedule, effort, risks, issues, change requests and quality,
- Taking corrective action,
- Replanning and rescheduling,
- Communicating progress to affected stakeholders,
- Preparing status reports and presentations.

The scope of the project needs to be determined, and the estimated effort for the various tasks and activities established. The project plan and schedule will then be developed and approved by the stakeholders, and these are maintained during the project. The project plan will contain or reference several other plans such as the project quality plan; the communication plan; the configuration management plan; and the test plan.

Project estimation and scheduling are difficult as software projects are often breaking new ground and differ from previous projects. That is, historical estimates may often not be a good basis for estimation for the current project. Often, unanticipated problems may arise for technically advanced projects, and the estimates may be overly optimistic.

Gantt charts are generally employed for project scheduling, and these show the work breakdown for the project as well as task dependencies and allocation of staff to the various tasks.

The effective management of risk during a project is essential to project success. Risks arise due to uncertainty, and the risk management cycle involves¹ risk identification; risk analysis and evaluation; identifying responses to risks; selecting and planning a response to the risk; and risk monitoring.

Once the risks have been identified, they are logged (e.g. in the risk log). The likelihood of each risk arising and its impact is then determined. The risk is assigned an owner and an appropriate response to the risk determined.

¹These are the risk management activities in the Prince2 methodology.

Once the planning is complete, the project execution commences, and the focus moves to monitoring progress, managing risks and issues, replanning as appropriate, providing regular progress reports to the project board and so on.

Two popular project management methodologies are the *Prince 2* methodology, which was developed in the UK, and *Project Management Professional (PMP)* and its associated project management body of knowledge (PMBOK) from the *Project Management Institute (PMI)* in the USA.

2.2 Project Start-up and Initiation

There are many ways in which a project may arise, but it is always essential that there is a clear rationale (*business case*) for the project. A telecoms company may wish to develop a new version of its software with attractive features to gain market share. An internal IT department may receive a request from its business users to alter its business software in order to satisfy new legal or regulatory requirements. A software development company may be contacted by a business to develop a bespoke solution to meet its needs and so on.

All parties must be clear on what the project is to achieve, and how it will be achieved. It is fundamental that there is a *business case* for the project (this is the reason for the project), as it clearly does not make sense for the organization to spend a large amount of money without a sound rationale for the project. In other words, the project must make business sense (e.g. it may have a financial return on the investment or it may be to satisfy some business or regulatory requirement).

At the project start-up, the initial scope and costing for the project are determined, and the feasibility of the project is determined.² The project is authorized,³ and a project board is set up for project governance. The project board verifies that there is a sound business case for the project, and a *project manager* is appointed to manage the project.

The *project board* (or steering group) includes the key stakeholders and is accountable for the success of the project. The project manager provides regular status reports to the project board during the project, and the project board is consulted when key project decisions need to be made.

The project manager is responsible for the day-to-day management of the project, and good planning is essential to its success. The approach to the project is decided,⁴ and the project manager *kicks off the project* and mobilizes the project team. The detailed requirements and estimates for the project are determined, the

²This refers to whether the project is technically and financially feasible.

³Organizations have limited resources, and as many projects may be proposed it will not be possible to authorise every project, and so several projects with weak business cases may be rejected.

⁴For example, it may be decided to outsource the development to a third party provider, purchase an off-the-shelf solution, or develop the solution internally.

schedule of activities and tasks established, and resources are assigned for the various tasks and activities.⁵ The project manager prepares the project plan, which is subject to the approval of the key stakeholders. The initial risks are identified and managed, and a risk log (or repository) is set up for the project. Once the planning is complete, project execution commences.

2.3 Estimation

Estimation is an important part of project management, and the accurate estimates of effort, cost and schedule are essential to delivering a project on time and on budget, and with the right quality.⁶ Estimation is employed in the planning process to determine the resources and effort required, and it feeds into the scheduling of the project. The problems with over- or underestimation of projects are well known, and good estimates allow the following:

- Accurate calculation of the project cost and its feasibility,
- Accurate scheduling of the project,
- Measurement of progress and costs against the estimates,
- Determining the resources required for the project.

Poor estimation leads to:

- Projects being over- or underestimated,
- Projects being over or under-resourced (impacting staff morale),
- Negative impression of the project manager.

Consequently, estimation needs to be rigorous, and there are several well-known techniques available (e.g. work-breakdown structures, function points and so on). Estimation applies to both the early and later parts of the project, with the later phases of the project refining the initial estimates, as a more detailed understanding of the project activities is then available. The new estimates are used to reschedule and to predict the eventual effort, delivery date and cost of the project. The following are guidelines for estimation:

- Sufficient time needs to be allowed to do estimation,
- Estimates are produced for each phase of software development,
- The initial estimates are high level,

⁵The project scheduling is usually done with the Microsoft Project tool.

⁶The consequences of under estimating a project include the project being delivered late, with the project team working late nights and weekends to recover the schedule, quality being compromised with steps in the process omitted, and so on.

- The estimates for the next phase should be solid, whereas estimates for the later phases may be high level,
- The estimates should be conservative rather than optimistic,
- Estimates will usually include contingency,
- Estimates should be reviewed to ensure their adequacy,
- Estimates from independent experts may be useful,
- It may be useful to prepare estimates using various methods and to compare.

Project metrics may be employed to measure the accuracy of the estimates. These metrics are reported during the project and include the following:

- Effort Estimation Accuracy,
- Budget Estimation Accuracy,
- Schedule Estimation Accuracy.

Next, we discuss various estimation techniques including the work-breakdown structure, the analogy method and the Delphi method.

2.3.1 Estimation Techniques

Estimates need to be produced consistently, and it would be inappropriate to have an estimation procedure such as “*Go ask Fred*”,⁷ as this clearly relies on an individual and is not a repeatable process. The estimates may be based on a work-breakdown structure, function points or another appropriate methodology. There are several approaches to project estimation (Table 2.1) including the following:

2.3.2 Work-Breakdown Structure

This is a popular approach to project estimation (*it is also known as decomposition*) and involves the following:

- Identify the project deliverables to be produced during the project,
- Estimate the size of each deliverable (in pages or LOC),
- Estimate the effort (number of days) required to complete the deliverable based on its complexity and size, and experience of team,
- Estimate the cost of the completed deliverable,
- The estimate for the project is the sum of the individual estimates.

⁷Unless “Go Ask Fred” is the name of the estimation methodology or the estimation tool employed.

Table 2.1 Estimation techniques

Technique	Description
Work-breakdown structure	Identify the project deliverables to be produced during the project. Estimate the size of each deliverable (in pages or LOC). Estimate the effort (number of days) required to complete the deliverable based on its size and complexity. Estimate the cost of the completed deliverable
Analogy method	This involves comparing the proposed project with a previously completed project (i.e. similar to the proposed project). The historical data and metrics for schedule, effort and budget estimation accuracy are considered, as well as similarities and differences between the projects to provide effort, schedule and budget estimates
Expert judgement	This involves consultation with experienced personnel to derive the estimate. The expert(s) can factor in differences between past project experiences, knowledge of existing systems and the specific requirements of the project
Delphi method	The <i>Delphi method</i> is a consensus method used to produce accurate schedules and estimates. It was developed by the Rand Corporation and improved by Barry Boehm and others. It provides extra confidence in the project estimates by using experts independent of the project manager or third party supplier
Cost predictor models	These include various cost prediction models such as <i>Cocomo</i> and <i>Slim</i> . The <i>Costar</i> tool supports <i>Cocomo</i> , and the <i>Qsm</i> tool supports <i>Slim</i>
Function points	<i>Function points</i> were developed by Allan Albrecht at IBM in the late 1970s and involve analysing each functional requirement and assigning a number of function points based on its size and complexity. This total number of function points is a measure of the estimate for the project

The approach often uses productivity data that is available from previously completed projects. The effort required for a complex deliverable is higher than that of a simple deliverable (where both are of the same size). The project planning section in the project plan (or a separate estimation plan) will include the lifecycle phases and the deliverables/tasks to be carried out in each phase. It may include a table along the following lines (Table 2.2).

2.4 Project Planning and Scheduling

A well-managed project has an increased chance of success, and good planning is an essential part of project management. There is the well-known adage that states, “*Fail to plan, plan to fail*”.⁸ The project manager and the relevant stakeholders will consider the appropriate approach for the project and determine whether a solution should be purchased off the shelf, whether to outsource the software development to

⁸This quotation is adapted from Benjamin Franklin (an inventor and signatory to the American declaration of independence).

Table 2.2 Example work-breakdown structure

Lifecycle phase	Project deliverable or task description	Est. size	Est. effort	Est. cost
Planning and requirements	Project plan	40	10 days	\$5000
	Project schedule	20	5 days	\$2500
	Business requirements	20	10 days	\$5000
	Test plan	15	5 days	\$2500
	Issue/risk log	3	2 days	\$1000
	Lessons learned log	1	1 day	\$500
Design	System requirements	15	5 days	\$2500
	Technical/DB design	30	10 days	\$5000
Coding	Source code	5000 (LOC)	10 days	\$5000
	Unit tests/results	200	2 days	\$1000
Testing	ST specs	30	10 days	\$5000
	System testing		10 days	\$5000
	UAT specs	30	10 days	\$5000
	UAT testing		10 days	\$5000
Deployment	Release notes/procedures	20	5 days	\$2500
	User manuals	50	10 days	\$5000
	Support procedures	15	10 days	\$5000
	Training plan	25	5 days	\$2500
Project closure	End project report	10	2 days	\$1000
	Lessons learned report	5	2 days	\$1000
Contingency	10%		13.4	\$6700
Total			147.4	\$73,700

a third party supplier or whether to develop the solution internally. A simple process map for project planning is presented in Fig. 2.1.

Estimation is a key part of project planning, and the effort estimates are used for scheduling of the tasks and activities in a project-scheduling tool such as *Microsoft Project* (Fig. 2.2).

The schedule will detail the phases in the project, the key project milestones, the activities and tasks to be performed in each phase as well as their associated timescales, and the resources required to carry out each task. The project manager will update the project schedule regularly during the project.

Projects vary in size and complexity, and the formality of the software development process employed needs to reflect this. The project plan defines how the project will be carried out, and it generally includes sections such as:

- Business case,
- Project scope,
- Project goals and objectives,
- Key milestones,

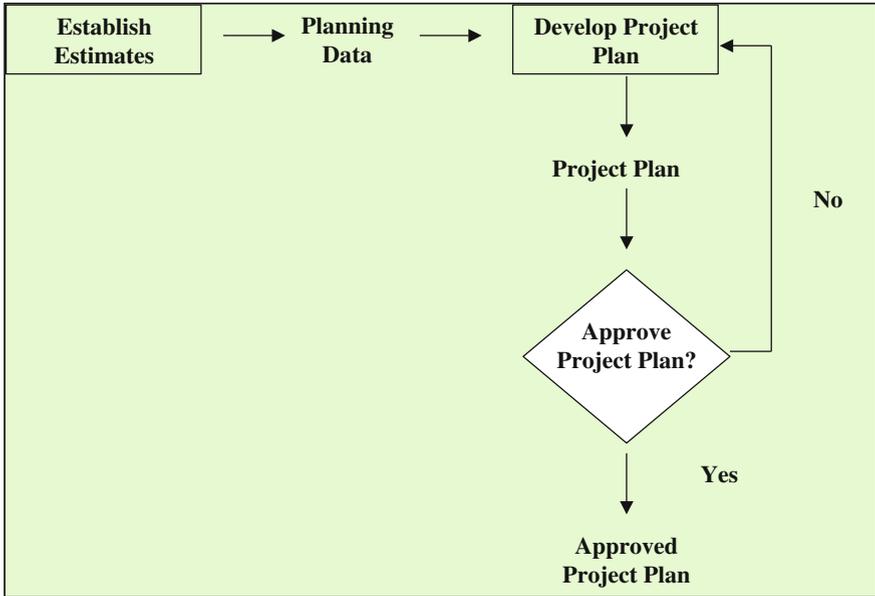


Fig. 2.1 Simple process map for project planning

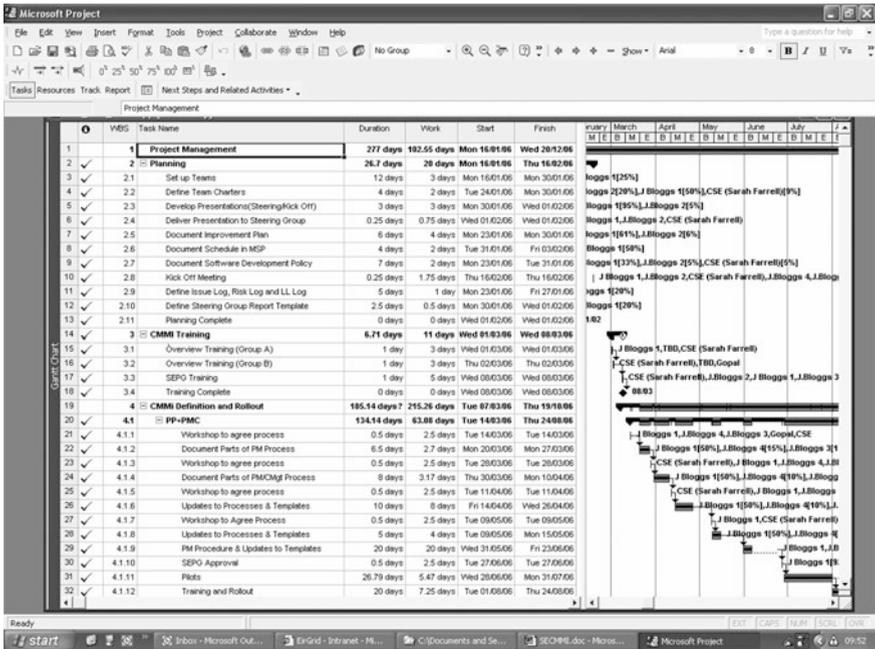


Fig. 2.2 Sample Microsoft project schedule

- Project planning and estimates,
- Key stakeholders,
- Project team and responsibilities,
- Knowledge and skills required,
- Communication planning,
- Financial planning,
- Quality and test planning,
- Configuration management.

Communication planning describes how communication will be carried out during the project, and it includes the various project meetings and reports that will be produced; financial planning is concerned with budget planning for the project; quality and test planning is concerned with the planning required to ensure that a high-quality product is delivered; and configuration management is concerned with identifying the configuration items to be controlled and systematically controlling changes to them throughout the lifecycle. It ensures that all deliverables are kept consistent following approved changes.

The project plan is a key project document, and it needs to be approved by all stakeholders. The project manager needs to ensure that the project plan, schedule and technical work products are kept consistent with the requirements. Another words, if there are changes to the requirement, then the project plan and schedule will need to be updated accordingly.

Checklists are useful in verifying that the tasks have been completed. The sample project management checklist below (Table 2.3) verifies that project planning has been appropriately performed and that controls are in place.

Table 2.3 Sample project management checklist

No.	Item to check
1.	Is the project plan complete and approved by the stakeholders?
2.	Does the project have a sound business case?
3.	Are the risk log, issue log and lessons learned log set up?
4.	Are the responses to the risks and issues appropriate?
5.	Is the Microsoft Schedule available for the project?
6.	Is the project schedule up to date?
7.	Is the project appropriately resourced?
8.	Are estimates available for the project? Are they realistic?
9.	Has quality planning been completed for the project?
10.	Has the change control mechanism been set up for the project?
11.	Are all deliverables under configuration management control?
12.	Has project communication been appropriately planned?
13.	Is the project directory set up for the project?
14.	Are the key milestones defined in the project plan?

2.5 Risk Management

Risks arise due to uncertainty, and *risk management is concerned with managing uncertainty*, and especially the management of any undesired events. Risks need to be identified, analysed and controlled in order for the project to be successful, and risk management activities take place throughout the project lifecycle.

Once the initial set of risks to the project has been identified, they are analysed to determine their *likelihood of occurrence* and their *impact* (e.g. on cost, schedule or quality). These two parameters determine the *risk category*, and the most serious risk category refers to a risk with a high probability of occurrence and a high impact on occurrence.

Countermeasures are defined to reduce the likelihood of occurrence and impact of the risks, and contingency plans are prepared to deal with the situation of the risk actually occurring. Additional risks may arise during the project, and the project manager needs to be proactive in their identification and management.

Risks need to be reviewed regularly especially following changes to the project. These could be changes to the business case or the business requirements, loss of key personnel and so on. Events that occur may affect existing risks (including the probability of their occurrence and their impact) and may lead to new risks. Countermeasures need to be kept up to date during the project. Risks are reported regularly throughout the project.

The risk management cycle is concerned with identifying and managing risks throughout the project lifecycle. It involves identifying risks; determining their probability of occurrence and impact should they occur; identifying responses to the risks; and monitoring and reporting. Table 2.4 describes these activities in greater detail:

The project manager will maintain a risk repository (this may be a tool or a risk log) to record details of each risk, including its type and description; its likelihood and its impact (yielding the risk category); and the response to the risk.

2.6 Quality Management in Projects

There are various definitions of “quality” such as Juran’s definition that quality is “*fitness for purpose*”, and Crosby’s definition of quality as “*conformance to the requirements*”. The Crosby’s definition is useful when asking whether we are building it right, whereas the Juran’s definition is useful when asking whether we are building the right system. Crosby’s definition is useful in requirements verification, where software inspections and testing verify that the requirements have been correctly implemented. Juran’s definition is useful in requirements validation.

It is a fundamental premise in the quality field that it is more cost effective to build quality into the product, rather than adding it later during the testing phase. Therefore, quality needs to be considered at every step during the project, and every

Table 2.4 Risk management activities

Activity	Description
Risk management strategy	This defines how the risks will be identified, monitored, reviewed and reported during the project, as well as the frequency of monitoring and reporting
Risk identification	This involves identifying the risks to the project and recording them in a risk repository (e.g. risk log). It continues throughout the project lifecycle. Prince 2 classifies risks into: <ul style="list-style-type: none"> – <i>Business</i> (e.g. collapse of subcontractors) – <i>Legal and regulatory</i> – <i>Organizational</i> (e.g. skilled resources/management) – <i>Technical</i> (e.g. scope creep, architecture, design) – <i>Environmental</i> (e.g. flooding or fires)
Evaluating the risks	This involves assessing the likelihood of occurrence of a particular risk and its impact (on cost, schedule, etc.) should it materialize. These two parameters result in the risk category.
Identifying risk responses	The project manager (and stakeholders) will determine the appropriate response to a risk such as reducing the probability of its occurrence or its impact should it occur. These include the following: <ul style="list-style-type: none"> – <i>Prevention</i> which aims to prevent it from occurring – <i>Reduction</i> aims to reduce the probability of occurrence or impact should it occur – <i>Transfer</i> aims to transfer the risk to a third party – <i>Acceptance</i> is when nothing can be done about it – <i>Contingency</i> is actions that are carried out should the risk materialize
Risk monitoring and reporting	This involves monitoring existing risks to verify that the actions taken to manage the risks are effective, as well as identifying new risks. This provides an early warning that an identified risk is going to materialize, and <i>a risk that materializes is a new project issue</i> that needs to be dealt with
Lessons learned	This is concerned with determining the effectiveness of risk management during the project and to learn any lessons for future projects

deliverable needs to be reviewed to ensure its fitness for purpose. The review may be similar to a *software inspection*, a *structured walk-through* or another appropriate methodology.

The project plan will include a section on quality planning for the project (this may be a reference to a separate plan). The quality plan will define how the project plans to deliver a high-quality project, as well as the quality controls and quality assurance activities that will take place during project execution. The quality planning for the project needs to ensure that the customer's quality expectations will be achieved.

The project manager has overall responsibility for project quality, and the quality department (if one exists) will assign a quality engineer to the project, and the quality engineer will promote quality and its importance to the project team, as well as facilitating quality improvement. The project manager needs to ensure that sound

software engineering processes are employed, as well as ensuring that the defined standards and templates are followed.

It is an accepted principle in the quality field that good processes and conformance to them are essential for the delivery of a high-quality product. The quality engineer will conduct process audits to ensure that the processes and standards are followed consistently during the project. An audit report is published, and any audit actions are tracked to closure.

Software testing is conducted to verify that the software correctly implements the requirements, and a separate project test plan will define the various types of testing to be performed during the project. These will typically include unit, integration, system, performance and acceptance testing and the results from the various test activities enable the fitness for purpose of the software to be determined, as well as judging whether it is ready to be released or not.

The project manager will report the various project metrics (including the quality metrics) in the regular project status reports, and the quality metrics provide an objective indication of the quality of the product at that moment in time.

The cost of poor quality may be determined at the end of the project, and this may require a time recording system for the various project activities. The effort involved in detecting and correcting defects may be recorded, and a COPQ chart similar to Fig. 10.28 presented.

Poor quality may arise due to several reasons. For example, it may be caused by inadequate reviews or testing of the software; inadequate skills or experience of the project team; or poorly defined or understood requirements.

The project manager will conduct a lessons learned meeting at the end of the project to identify and record all of the lessons learned from the project. These are then published as a lessons learned report and shared with relevant stakeholders as part of continuous improvement.

2.7 Project Monitoring and Control

Project monitoring and control are concerned with monitoring project execution and taking corrective action when project performance deviates from expectations. The progress of the project should be monitored against the plan and corrective actions taken as appropriate. The key project parameters such as budget, effort and schedule as well as risks and issues are monitored, and the status of the project communicated regularly to the affected stakeholders.

The project manager will conduct progress and milestone reviews to determine the actual progress, with new issues identified and monitored. The appropriate corrective actions are identified and are tracked to closure. The main focus of project monitoring and control is as follows:

- Monitor the project plan and schedule and keep on track,
- Monitor the key project parameters,

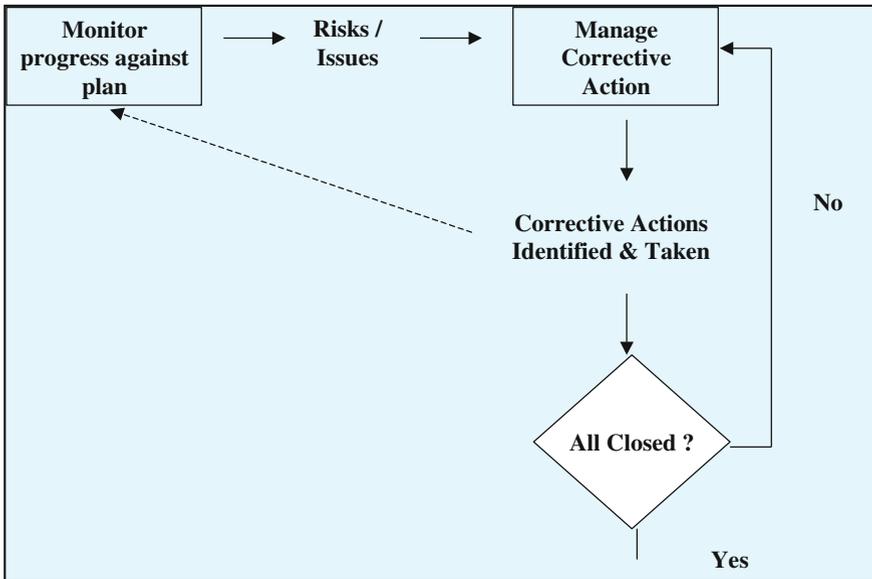


Fig. 2.3 Simple process map for project monitoring and control

- Conduct progress and milestone reviews to determine the actual status,
- Replan as appropriate,
- Monitor risks and take appropriate action,
- Analyse issues and change requests and take appropriate action,
- Track corrective action to closure,
- Monitor resources and manage any resource issues,
- Report the project status to management and project board.

A sample process map is presented in Fig. 2.3.

The project manager will monitor progress, risks and issues during the project, and take appropriate corrective action. The status of the project will be reported in the regular status reports sent to management and the project board, with the status reviewed with management regularly during the project.

2.8 Managing Issues and Change Requests

The management of issues and change requests is a normal part of project management. An *issue* can arise at any time during the project (e.g. a supplier to the project may go out of business, an employee may resign, specialized hardware for testing may not arrive in time and so on), and an issue refers to a problem that has occurred which may have a negative impact on the project. The severity of the issue is an indication of its impact on the project, and the project manager needs to manage it appropriately.

Table 2.5 Activities in managing issues and change requests

Activity	Description of issue/change request
Log issue or change request	The project manager logs the issue or change request. It is assigned to a unique reference number and priority (severity), and categorized into an issue (problem) or change request
Assess impact	This involves analysis to determine the impacts such as technical, cost, schedule and quality. The risks need to be identified
Decision on implementation	A decision is made on how to deal with the issue or change request. The CCB is often involved in the decision to authorize a change request
Implement solution	The affected project documents and software modules are identified and modified accordingly
Verify solution	Testing (Unit, System and UAT) is employed to verify the correctness of the solution
Close issue/CR	The issue or change request is closed

A *change request* is a stakeholder request for a change to the scope of the project, and it may arise at any time during the project. The impacts of the change request (e.g. technical, cost and schedule) need to be carefully considered, as a change introduces new risks to the project that may adversely affect cost, schedule and quality. It is therefore essential to fully understand the impacts in order to make an informed decision on whether to authorize or reject the change request. The project manager may directly approve small change requests, with the impacts of a larger change request considered by the project *change control board* (CCB).

The activities involved in managing issues and change requests are summarized in Table 2.5.

2.9 Project Board and Governance

The *project board*⁹ (or steering group) is responsible for directing the project, and it is directly accountable for the success of the project. It consists of senior managers and staff in the organization who have the authority to make resources available, to remove roadblocks and to get things done.

It is consulted whenever key project decisions need to be made, and it plays a key role in project governance. The project board ensures that there is a clear business case for the project, and that the capital funding for the project is adequate and well spent. The project board may cancel the project at any stage during project

⁹The project board in the Prince 2 methodology includes roles such as the project executive, senior supplier, senior user, project assurance, and the project manager. These roles have distinct responsibilities.

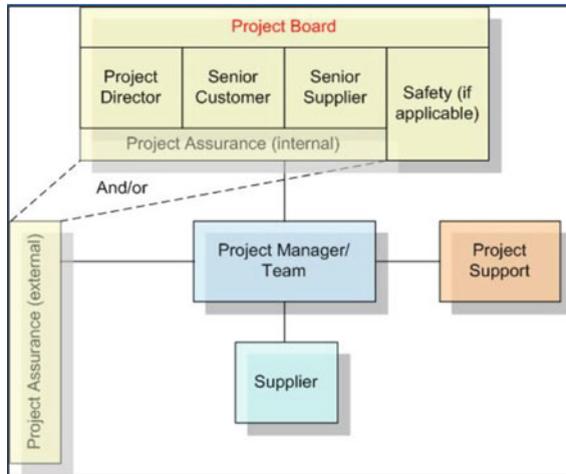


Fig. 2.4 Prince 2 project board

Table 2.6 Project board roles and responsibilities

Role	Responsibility
<i>Project director</i>	Ultimately responsible for the project. Provides overall guidance to the project
<i>Senior customer</i>	Represents the interests of users
<i>Senior supplier</i>	Represents the resources responsible for implementation of project (e.g. IS manager)
<i>Project manager</i>	Link between project board and project team
<i>Project assurance</i>	Internal role (optional) that provides an independent (of project manager) objective view of the project
<i>Safety (optional)</i>	Ensure adherence to health and safety standards

execution should there cease to be a business case, or should project spending exceed tolerance and go out of control.¹⁰

The project manager reports to the project board and sends regular status reports to highlight progress made as well as key project risks and issues. The project board meets at an appropriate frequency during the project (with extra sessions held should serious project issues arise) (Fig. 2.4).

There are several roles on the project board (an individual could perform more than one role) and their responsibilities include (Table 2.6) the following:

¹⁰The project plan will usually specify a *tolerance level* for schedule and spending, where the project may spend (perhaps less than 10%) in excess of the allocated capital for the project before seeking authorization for further capital funding for the project.

2.10 Project Reporting

The frequency of project reporting is defined in the project plan (or the communications plan). The project report advises management and the key stakeholders of the current status of the project and includes key project information such as:

- Completed deliverables (during period),
- New risks and issues,
- Schedule, effort and budget status (e.g. RAG metrics¹¹),
- Quality and test status,
- Key risks and issues,
- Milestone status,
- Deliverables planned (next period).

The project manager discusses the project report with management and the project board and presents the current status of the project as well as the key risks and issues. The project manager will present a recovery plan (exception report) to deal with the situation where the project has fallen significantly outside the defined project tolerance (i.e. it is significantly behind schedule or over budget).

The key risks and issues will be discussed, and the project manager will explain how the key issues are being dealt with, and how the key risks will be managed. The new risks and issues will also be discussed, and the project board will carefully consider how the project manager plans to deal with these and will provide appropriate support.

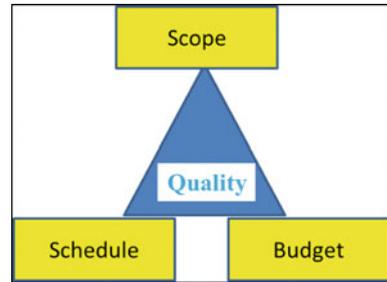
The project board will carefully consider the status of the project as well as the input from the project manager before deciding on the appropriate course of action (which could include the immediate termination of the project if there is no longer a business case for it).

2.11 Project Closure

A project is a temporary activity, and once the project goals have been achieved and the product handed over to the customer and support group, it is ready to be closed. The project manager will prepare an end of project report detailing the extent to which the project achieved its targeted objectives. The report will include a summary of key project metrics including key quality metrics and the budget and timeliness metrics.

¹¹Often, a colour coding mechanism is employed with a red flag indicating a serious issue; amber highlighting a potentially serious issue; and green indicating that everything is ok.

Fig. 2.5 Project management triangle



The success of the project is judged on the extent to which the defined objectives have been achieved, and on the extent to which the project has delivered the agreed functionality on schedule, on budget and with the right quality. This is often referred to as the project management triangle (Fig. 2.5).

The project manager presents the end project report to the project board, including any factors (e.g. change requests) that may have affected the timely delivery of the project or the allocated budget. The project is then officially closed.

The project manager then schedules a meeting with the team review the lessons learned from the project. The team records the lessons learned during the project (typically in a lessons learned log), and the key lessons learned are summarized in the lessons learned report. Any actions identified are assigned to individuals and followed through to closure, and the lessons learned report is made available to other projects (with the goal of learning from experience). The project team is disbanded, and the project team members are assigned to other duties.

2.12 Prince 2 Methodology

Prince 2 (*Projects in controlled environments*) is a popular project management methodology that is widely used in the UK and Europe. It is a structured, process-driven approach to project management, with processes for project start-up, initiating a project, controlling a stage, managing stage boundaries, closing a project, managing product delivery, planning and directing a project (Fig. 2.6). It has procedures to coordinate people and activities in a project, as well as procedures to monitor and control project activities.

These key processes are summarized in Table 2.7, and more detailed information on Prince 2 is in [1].

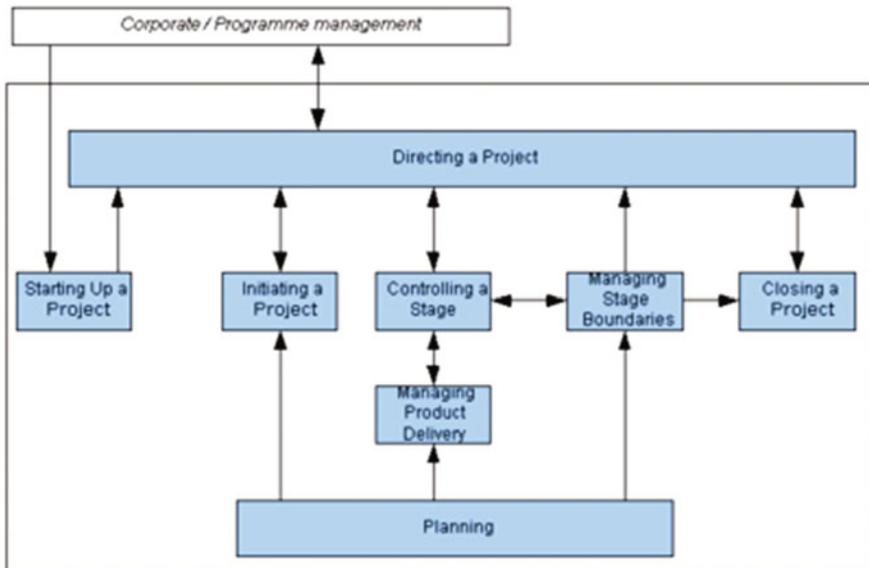


Fig. 2.6 Prince 2 processes

Table 2.7 Key processes in Prince 2

Process	Description
Start-up	Project manager and project board appointed, project approach and project brief defined
Initiating	Project and quality plan completed, business case and risks refined, project files set up and project authorized
Controlling a stage	Stage plan prepared, quality and risks/issues managed, progress reviewed and reported
Managing stage boundary	Stage status reviewed and next stage planned, actual products produced versus original stage plan compared, stage or exception report produced
Closing a project	Orderly closure of project with project board, end project report and lessons learned report
Managing product delivery	Covers product creation by the team or a third party supplier. Ensure that the planned deliverables meet quality criteria
Planning	Prince 2 employs product-based planning which involves identifying the products required, and the activities and resources to provide them
Directing a project	The project board consists of senior management, and it controls the project. It has the authority to authorize and define what is required from the project, commitment of resources and funds and management direction

2.13 Review Questions

1. What is a project? What is project management?
2. Describe various approaches to estimation.
3. What activities take place at project start-up and initiation?
4. What skills are required to be a good project manager?
5. What is the purpose of the project board? Explain project governance.
6. What is the purpose of risk management? How are risks managed?
7. Describe the main activities in project management.
8. What is the difference between a risk and an issue?
9. What is the purpose of project reporting?
10. How is quality managed in a project?

2.14 Summary

Project management is concerned with the effective management of projects, and the goal is to deliver a high-quality product, on time and on budget, to the customer. It involves good project planning and estimation; managing resources; managing changes and issues that arise; managing quality; managing risks; managing the budget; monitoring progress and taking corrective action; communicating progress; and delivering a high-quality product to the customer.

The scope of the project needs to be determined and estimates established. The project plan is developed and approved by the stakeholders, and it will contain or reference several other plans. It needs to be maintained during the project. Project estimation and scheduling are difficult as often software projects are quite different from previous projects. Gantt charts are often employed for project scheduling, and these show the work breakdown for the project, as well as task dependencies and the assignment of staff to the various tasks.

The effective management of risk during a project is essential to project success. Risks arise due to uncertainty, and the risk management cycle involves risk identification; risk analysis and evaluation; identifying responses to risks; selecting and planning a response to the risk; and risk monitoring.

Once the planning is complete, the project execution commences, and the focus moves to monitoring progress, replanning as appropriate, managing risks and issues, providing regular progress reports to the project board and so on. Finally, there is an orderly close of the project.

Reference

1. Office of Government Commerce, *Managing Successful Projects with PRINCE2*, 2004