Chapter 9

Monitoring and control
Introduction

- Once work schedules have been published and the project is under way, attention must be focused on ensuring progress.
- This requires monitoring of what is happening, comparison of actual achievement against the schedule and where necessary, revision of plans and schedules to bring the project as far as possible back on target.
- In this chapter, we will discuss how information about project progress is gathered and what actions must be taken to ensure a project meets its targets.
- Finally we will discuss change control
Creating the framework

- Exercising control over a project and ensuring that targets are met is a matter of regular monitoring, finding out what is happening, and comparing it with current targets.
- If there is a mismatch between the planned outcomes and the actual ones, then either preplanning is needed to bring the project back on target or the target will have to be revised.
Creating the framework-The control cycle

Figure 1: The project control cycle
Creating the framework-The control cycle

- **Define objectives** – at the beginning of the project we decide on what we want to achieve
- **Making decisions/plans** – we decide how we are going to achieve the objectives i.e. we create a plan
- **Modelling** – as part of the process of creating a plan we will consider different approaches and attempt to assess the consequences of each of these approaches in terms of how much it will cost and how long it will take, and so on.
- **Implementation** – the plan is now carried out
Creating the framework-The control cycle

- **Data collection** – we gather information at regular intervals about how the project is progressing. These raw details could be quite numerous and complex on a large project.

- **Data processing** – we process the progress data and convert it into ‘information’ which makes it easier for the project managers and others to understand the overall condition of the project.

- **Making decisions/plans** – in the light of the comparison of actual project progress with that planned, the plans are modified. This may require the modelling of the outcomes of different possible courses of action.

- …and so the cycle goes on.
Creating the framework - Responsibilities

- The overall responsibility for ensuring satisfactory progress on a project is often the role of the project steering committee or project board.
- Day-to-day responsibility will rest with the project manager, and in all but the smallest projects, aspects of this can be delegated to team leaders.
Creating the framework - Responsibilities

Figure 2: Project reporting structures
Creating the framework-Assessing progress

Checkpoints – predetermined times when progress is checked

- Event driven: check takes place when a particular event has been achieved
- Time driven: date of the check is predetermined

Frequency of reporting

The higher the management level then generally the longer the gaps between checkpoints
Collecting progress details

Need to collect data about:
- Achievements
- Costs

A big problem: how to deal with partial completions

99% completion syndrome

Possible solutions:
- Control of products, not activities
- Subdivide into lots of sub-activities
Partial completion reporting

- Many organizations use standard accounting systems with weekly timesheets to charge staff time to individual jobs.
- The staff time booked to a project indicates the work carried out and the charges to the project.
- It does not tell the project manager what has been produced or whether tasks are on schedule.
- It is therefore common to adapt or enhance existing accounting data collection systems to meet the needs of project control.
- Weekly timesheets, are frequently adapted by breaking jobs down to activity level and requiring information about work done in addition to time spent.
## Collecting progress details

### Figure 3: A weekly timesheet and progress review form

<table>
<thead>
<tr>
<th>Project</th>
<th>Activity code</th>
<th>Description</th>
<th>Hours this week</th>
<th>% complete</th>
<th>Scheduled completion</th>
<th>Estimated completion</th>
</tr>
</thead>
<tbody>
<tr>
<td>P21</td>
<td>A243</td>
<td>Code mod A3</td>
<td>12</td>
<td>30</td>
<td>24/4/07</td>
<td>24/4/07</td>
</tr>
</tbody>
</table>

| Total rechargeable hours | 32 |

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Hours this week</th>
<th>Comment and authorization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z99</td>
<td>Day in lieu</td>
<td>8</td>
<td>Authorized by RB</td>
</tr>
</tbody>
</table>

| Total non-rechargeable hours | 8 |

SPM (5e) monitoring and control © The McGraw-Hill Companies, 2009
Red/Amarber/Green (Risk) reporting

- Identify key tasks
- Break down into sub-tasks
- Assess subtasks as:
  - Green – ‘on target’
  - Amber – ‘not on target but recoverable’
  - Red – ‘not on target and recoverable only with difficulty’
- Status of ‘critical’ tasks is particularly important
# Red/Amber/Green (Risk) reporting

**Activity Assessment Sheet**

Staff: Justin

<table>
<thead>
<tr>
<th>Ref: IoE/P/13</th>
<th>Activity: Code and test module C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week number</td>
<td>13 14 15 16 17 18</td>
</tr>
<tr>
<td>Activity summary</td>
<td>G A A R</td>
</tr>
<tr>
<td>Component</td>
<td></td>
</tr>
<tr>
<td>Screen handling procedures</td>
<td>G A A G</td>
</tr>
<tr>
<td>File update procedures</td>
<td>G G R A</td>
</tr>
<tr>
<td>Housekeeping procedures</td>
<td>G G G A</td>
</tr>
<tr>
<td>Compilation</td>
<td>G G G R</td>
</tr>
<tr>
<td>Test data runs</td>
<td>G G G A</td>
</tr>
<tr>
<td>Program documentation</td>
<td>G G A R</td>
</tr>
</tbody>
</table>

**Figure 4: A traffic light assessment of IOE/P/13**
Visualizing progress

Methods:
- The Gantt chart
- The slip chart
- The timeline
Gantt charts

Figure 5: Part of Amanda’s Gantt chart with the ‘today cursor’ in week 17
Figure 6: The slip chart emphasizes the relative position of each activity.
The timeline

Figure 7: Brigette’s timeline chart at the end of week six
Cost monitoring

- Expenditure monitoring is an important component of project control.
- Not only in itself, but also because it provides an indication of the effort that has gone into a project.
- A project might be on time but only because more money has been spent on activities than originally budgeted.
Cost monitoring

Figure 8: Tracking cumulative expenditure
Cost monitoring

Figure 9: The cumulative expenditure chart can also show revised estimates of cost and completion date.
Earned value analysis

- **Planned value (PV) or Budgeted cost of work scheduled (BCWS)** – original estimate of the effort/cost to complete a task (compare with idea of a ‘price’)

- **Earned value (EV) or Budgeted cost of work performed (BCWP)** – total of PVs for the work completed at this time
Accounting conventions

Work completed allocated on the basis

- \(50/50\) half allocated at start, the other half on completion. These proportions can vary e.g. \(0/100, 75/25\) etc

- *Milestone* current value depends on the milestones achieved
The baseline budget

The first stage in setting up an earned value analysis is to create the baseline budget.

The baseline budget is based on the project plan and shows the forecast growth in earned value through time.

Earned value may be measured in monetary values but, in the case of staff-intensive projects such as software development, it is common to measure earned value in person-hours or work-days.
The baseline budget

Figure 10: Amanda’s baseline budget
The baseline budget

Figure 11: Amanda’s earned value analysis at week 12
Having created the baseline budget, the next task is to monitor earned value as the project progress. This is done by monitoring the completion of tasks (or activity starts and milestone achievements in the case of the other crediting techniques).
Monitoring earned value

- Actual cost (AC)
- Schedule variance (SV)
- Cost variance (CV)
- Performance ratios
- Time variance (TV)
As well as recording EV, the actual cost of each task can be collected as actual cost (AC).

This is also known as the actual cost of work performed (ACWP).
Figure 12: An earned value tracking chart
Schedule variance

- The schedule variance is measured in cost terms as EV-PV and indicates the degree to which the value of completed work differs from that planned.
- A negative SV means the project is behind schedule.
Cost variance

- This is calculated as EV-AC and indicates the difference between the budgeted cost and the actual cost of completed work.
- It is also an indicator of the accuracy of the original cost estimates.
- A negative CV means the project is over cost.
Performance ratios

- Two ratios:
  - Cost performance index (CPI=EV/AC)
  - Schedule performance index (SPI=EV/PV)
- A value greater than one means that work completed better than planned, whereas a value of less than one means that work is costing more than and/or proceeding more slowly than planned.
- EAC: estimate at completion
  - EAC= BAC/CPI where BAC (budget at completion) is the current projected budget for the project.
Earned value analysis – actual costs

Figure 13: An earned value chart with revised forecasts
Time variance

- Time variance (TV) – difference between time when specified EV should have been reached and time it actually was
- For example say an EV of £19000 was supposed to have been reached on 1\textsuperscript{st} April and it was actually reached on 1\textsuperscript{st} July then TV = -3 months
Earned value – an example

- Tasks
  - Specify module: 5 days
  - Code module: 8 days
  - Test module: 6 days

- At the beginning of day 20, PV = 19 days
- If everything but testing completed EV = 13 days
- Schedule variance = EV-PV i.e. 13-19 = -6
- Schedule performance indicator (SPI) = 13/19 = 0.68
- SV negative or SPI <1.00, project behind schedule
- A negative schedule variance (SV) means that the project is behind schedule as does a SPI that is less than 1.0.
Earned value – an example (cont’)

- Actual cost (AC) is also known as Actual cost of work performed (ACWP)
- In previous example, if
  - ‘Specify module’ actually took 3 days
  - ‘Code module’ actually took 4 days
- Actual cost = 7 days
- Cost variance (CV) = EV-AC i.e. 13-7 = 6 days
- Cost performance indicator = 13/7 = 1.86
- Positive CV or CPI > 1.00 means project within budget
Prioritizing monitoring

We might focus more on monitoring certain types of activity e.g.

- Critical path activities
- Activities with no free float – if delayed later dependent activities are delayed
- Activities with less than a specified float
- High risk activities
- Activities using critical resources
Getting the project back to target: options

- Renegotiate the deadline – if not possible then
- Try to shorten critical path e.g.
  - Work overtime
  - Re-allocate staff from less pressing work
  - Buy in more staff
- Reconsider activity dependencies
  - Over-lap the activities so that the start of one activity does not have to wait for completion of another
  - Split activities
Change control

The role of configuration librarian:

- The identification of all items that are subject to change control
- The establishment and maintenance of a central repository of the master copies of all project documentation and software products.
- The setting up and running of a formal set of procedures to deal with changes.
- The maintenance of records of who has access to which library items and the status of each library item.
Typical change control process

1. One or more users might perceive the need for a change
2. User management decide that the change is valid and worthwhile and pass it to development management
3. A developer is assigned to assess the practicality and cost of making the change
Typical change control process contd.

4. Development management report back to user management on the cost of the change; user management decide whether to go ahead

5. One or more developers are authorized to make copies of components to be modified
Typical Change control process contd.

6. Copies modified.

7. After initial testing, a test version might be released to users for acceptance testing

7. When users are satisfied then operational release authorized – master configuration items updated
Conclusion

- In this chapter we have discussed the requirements for continual monitoring of projects and the need for making progress visible.
- Among the important points to emerge were:
  - Planning is pointless unless the execution of the plan is monitored.
  - Activities that are too long need to be subdivided to make them more controllable.
  - Ideally, progress should be measured through the delivery of project products.
  - Cost needs to be monitored as well as elapsed time.
  - Delayed projects can be brought back on track by shortening activity times on the critical path or by relaxing some of the precedence constraints.