Chapter 9 Monitoring and control

Further exercises and pointers

1. Take a look at Amanda's project schedule shown in Figure 8.7. Identify those activities scheduled to last more than three weeks and describe how she might monitor progress on each of them on a fortnightly or weekly basis.

The activities scheduled to take more than three weeks are:

IoE/P/1	Specify overall system	34 days
IoE/P/2-5	Specify module A,B,C,D	20,15,25 and 15 days
IoE/P/11-14	Code/test module A,B,C,D	30, 28, 15 and 25 days

The general way of dealing with this is to break down the tasks into smaller stages which have their own intermediate products and which can act as milestones against which Amanda can assess progress. In addition to, or instead of, this breaking down into stages, the major product that is created by an activity could be sub-divided into a number of component products each of which can be created in turn. Each of these components act as a lesser milestone.

Specify overall system – methodologies present ready made sets of intermediate stages and products. For example SSADM provides these:

- Define required system processing
- Develop required data model
- Derive system functions (includes I/O structures and function definitions)
- Enhance the required data model
- Develop processing specifications (entity life histories, effect correspondence diagrams, entity access paths)
- Confirm system objectives
- Assemble requirements specification

(Ed Downs, Peter Clare and Ian Coe *Structured Systems Analysis and Design Method* (2e) Prentice Hall 1992)

An object oriented UML approach might list products like:

- Use cases and actors
- Class diagrams
- Interaction diagrams
- State and activity diagrams

(Simon Bennett, Steve McRobb and Ray Farmer *Object-oriented systems analysis and design using UML* McGraw-Hill 1999)

Specify module If a UML approach was used the products that could provide controls would include:

- Design class diagrams
- Interaction diagrams
- Prototype dialogue design
- State charts for the interface

Code/test module. Having identified the component elements in the design document that map onto code components, a check list of these could be used to monitor and control the code implementation process.

2. Amanda's Gantt chart at the end of week 17 (Figure 9.5) indicates that two activities are running late. What effect might this have on the rest of the project? How might Amanda mitigate the effects of this delay?

The two activities that are running late by two days are 'Code/test module B' and 'Code/test module C'. These activities are both on critical paths as they are already due to finish one day after 'Code/test module A' which in the original plan was on the critical path.

One way in which Amanda could try to expedite matters could be to ask Spencer, who has now completed his assigned work, to help Purdy and Justin in the preparation and running of test cases as a means of expediting the work.

3. Table 9.2 illustrates Amanda's earned value calculations based on workdays. Revise the table using monetary values based on the cost figures that you used in Exercise 8.5. Think carefully about how to handle the costs of Amanda as project manager and the recovered overheads and justify your decisions about how you treat them.

task	budget workdays	day rate	wages	scheduled completion day	cumulative planned value	% cumulative earned value
specify overall systems	34	300	10200	34	10200	20.92%
specify module B	15	250	3750	49		
specify module D	15	175	2625	49	16575	34.00%
specify module A	20	225	4500	54	21075	43.23%
check specifications	2	300	600	56	21675	44.46%
design module D	4	175	700	60	22375	45.90%
design module A	7	225	1575	63	23950	49.13%
design module B	6	175	1050	66	25000	51.28%
check module C specification	1	300	300	70	25300	51.90%
specify module C	25	250	6250	74	31550	64.72%
design module C	4	250	1000	79	32550	66.77%
code and test module D	25	150	3750	85	36300	74.46%
code and test module A	30	150	4500	93	40800	83.69%
code and test module B	28	150	4200	94		
code and test module C	15	150	2250	94	47250	96.92%
system integration	6	250	1500	100	48750	100.00%

You could argue that the oncost and Amanda's management time could be ignored on the grounds that essentially the EVA figures indicate the relative proportions of work completed, rather than money values as such.

However, EVA might be tied in with the mechanism by which the client is charged for work completed and so it may be important to make sure that all costs are in fact included. The overheads could be distributed to activities on a pro-rata basis. This means that the overheads are shared between the activities in proportion to the days that each activity takes. (An alternative could be to share out the overheads in proportion to their planned value).

4. If you have access to project planning software, investigate the extent to which it offers support for earned value analysis. If it does not do so directly, investigate ways in which it would help you to generate a baseline budget (PV) and track the earned value (EV).

5. Describe a set of change control procedures that would be appropriate for Brigette to implement at Brightmouth College.

This could (and has) been used as a basis for a tutorial activity. My approach was to try to get the students to consider firstly the likely differences in working practices and relationships between large and small organizations. (There could be a debate about whether Brightmouth College is a 'small' organization – it could well have hundreds of employees of different types and if each course is considered as a 'product' a very diverse product range).

With smaller organizations, communications between the internal provider of IS services and the client 'business' managers are likely to be relatively frequent and informal. One would not expect the barriers to communication that the sheer size and geographical dispersion brings in larger organizations. However, a disadvantage of informality of communication is possible misunderstandings about the current status of proposals for change – was the client just musing about the possibility of a change or do they afterwards think that there was a definite decision to go ahead?

With the developers in a small organization, informal methods of working are likely to prevail. Over time this can lead to confusion about, for example, the location of the latest version of a software component or document. In an informal environment horrors such as uncontrolled changes to operational systems can occur. Some formality therefore needs to be introduced, but these processes need to be neither overly bureaucratic or unnecessarily time-consuming. The key is to assess the costs and benefits, in the current environment, of each measure. (i.e. requires 'critical thinking'!)

In Chapter 2 it is suggested that Brigette would ensure that:

- No job of work to change a system or implement a new one is to be done without there being a detailed specification first;
- The users agree and 'sign off' each specification in writing

On the technical side some suggestions are:

- Some form of version numbering for software components and documentation is required. Comments in the source code of the software could identify which changes this version is incorporating;
- The 'live', operational, versions of software need to be kept physically separate from versions under development
- A spreadsheet or the equivalent could hold details of the status of each software component and who, if anyone, is currently working on it.

6. Give examples of errors that can be identified in a design review.
Missing functionalities, extra functionalities implemented, incorrect functionality implementation, etc.

7. Give examples of how project termination review results can change the development process and the project management process.

The project termination review might point out that frequent customer interactions were necessary, and this may later be incorporated in the development process.

8. Suppose a project is budgeted to cost £150,000. The project is to be completed in 18 months. After two months, the project is 10% complete at an expense of £25,000. It was planned that after 2 months, 15% of the project work should have been completed. Compute the cost performance index and the schedule performance index. Interpret these values to assess the progress of the project.

Planned value (PV) = Planned percentage completion of work × budgeted cost = 15% × £150,000 = £22,500

Earned value (EV) = Percentage work actually completed × budgeted cost = 10% × £150,000 = £15,000

Cost performance index (CPI) = EV/actual cost incurred = EV/AC =£15,000/£25,000=0.6

Schedule performance index (SPI) = EV/PV = £15,000/£22,500= 0.66

Assessment of project performance: Since CPI is less that 1, the project is over-budget. For every pound spent, we are getting 0.6 worth of work. SPI is also less than 1, indicating that the project is lagging behind the schedule. At this rate, the project will be completed late and also would be over-budget. Therefore, corrective actions need to be taken.

9. What problems are you likely to face if you are developing several versions of the same software product according to a client's request, and you are not using any configuration management tools?

The following problems might arise:

- Inconsistency problem when the objects are replicated.
- Problems associated with concurrent access.
- Providing a stable development environment.
- System accounting and maintaining status information.
- Handling variants.

10. What do you understand by software configuration? What is meant by software configuration management? How can you manage software configuration (only mention the names of the principal activities involved)? Why is software configuration management crucial to the success of large software product development projects (write only the important reasons)?

The state of all deliverable items at any point of time is called the configuration of the software product. Software configuration management involves effectively managing the configuration. Software configuration can be managed through:

- Configuration identification
- Configuration control

11. What is a baseline in the context of software configuration management? How do baselines get updated to form new baselines?

A baseline is a software configuration that has been formally reviewed and agreed upon and serves as a basis for further development.

Updation of the baseline requires the permission of a change control board (CCB).

The CCB is usually constituted from among the development team members. For every change that needs to be carried out, the CCB reviews the changes made to the controlled work product and certifies several things about the change:

- Change is well-motivated.
- Developer has considered and documented the effects of the change.
- Changes interact well with the changes made by other developers.
- Appropriate people (CCB) have validated the change, e.g. someone has tested the changed code, and has verified that the change is consistent with the need.

12. Explain how the following are prevented while using a configuration management tool:

- *Two team members overwriting each other's work*
- *Accidental deletion of work product*
- *Unauthorized modifications to a work product*

Two team members overwriting each other's work: A member can modify a work product only after executing a reserve command. A unit can only be reserved by one member at a time. This prevents accidental overwrites.

Accidental deletion of work product: Accidental deletion of work products is prevented because each incremental modification is stored and it is possible to any previous state of a work product.

Unauthorized modifications to a work product: Unauthorized modifications are prevented as every updation to the baseline has to be approved by the project manager. Without a manager's authorization, it is not possible to modify a work product.

Further exercises that are not in the textbook

13. A project involves the design and building of four software modules, called A,B, C and D respectively. The estimated effort for each of the modules is 40 hours for A, 30 for B, 50 for C and 45 for D.
The organization that is undertaking the work assumes for EVA purposes that design takes up 30% of the effort, coding 40% and testing 30%.

On the day that this EVA is conducted, the project should have been completed in full. In fact the situation is as follows:

Module	*estimated effort*	*design (actual hrs)*	*code (actual hrs)*	*test (actual hrs)*
A	*40*	*14*	*18*	*14*
B	*30*	*7*	*10*	*5*
C	*50*	*16*	*not completed*	*not completed*
D	*45*	*10*	*not completed*	*not completed*

Where actual hours are shown the task has been completed.

Calculate the schedule and cost variances and the cost performance and schedule performance indicators. What general conclusion might be drawn from these figures about the overall state of the project?

Module	Overall estimated effort	Est. design hrs 30%	Actual design hours	Est coding hrs (40%)	Actual coding hours	Est Test hours	Actual testing hours
A	40	12	14	16	18	12	14
B	30	9	7	12	10	9	5
C	50	15	16	20	not completed	15	not completed
D	45	13.5	10	18	not completed	13.5	not completed
Pv	165						
Ev	98.5	49.5		28		21	
Ac	94		47		28		19

Schedule variance is ev – pv i.e. or 98.5 – 165 = -66.5. The schedule performance indicator is ev/pv i.e. 98.5/165 = 0.60. This means that the work is about 40% incomplete, that is seriously behind schedule. The cost variance is ev – ac or 98.5-94 i.e. +4.5. The cost performance indicator is 98.5/94 or 1.05. Where work is being completed, it is being done within the budget. This implies that the problems with the schedule are not necessarily to do with productivity. Non-completion of modules C and D could be because of resource shortages or external events.

14. A project involves the design and building of four software modules, called W,X, Y and Z respectively. The estimated effort for each of the modules is 60 days for A, 30 for B, 40 for C and 45 for D.
The organization that is undertaking the work assumes for the purpose of earned value analysis (EVA) that design takes up 30% of the effort, coding 40% and testing 30%.

On the day that this EVA is conducted, the project should have been completed in full. In fact the situation is as follows:

Module	*estimated effort*	*design (actual hrs)*	*code (actual hrs)*	*test (actual hrs)*
A	*60*	*25*	*40*	*not completed*
B	*30*	*15*	*15*	*15*
C	*40*	*15*	*not completed*	*not completed*
D	*45*	*10*	*not completed*	*not completed*

Where actual hours are shown the task has been completed.

Calculate the schedule and cost variances.

Calculate the cost performance and schedule performance indicators.

What general conclusion might be drawn from these figures about the overall state of the project?

module	estimated effort	estimated design hours	design (actual hrs)	estimated code hours	code (actual hrs)	Estimated test hours	test (actual hrs)
		30%		40		30	
A	60	18	25	24	40	18	not completed
B	30	9	15	12	15	9	15
C	40	12	15	16	not completed	12	not completed
D	45	13.5	10	18	not completed	13.5	not completed
pv	175						
ev	97.5	52.5		36		9	
ac	135		65		55		15
sv	-77.5		spi	0.56			
cv	-37.5		cpi	0.72			

In this case, the project is both behind schedule and over budget. The problems could be caused by poor productivity or by inaccurate estimates, among other things

15. Explain how the details needed to carry out earned value analysis would be collected.

Planned value – this would have to come out of the planning and costing process.
Earned value – periodic checkpoint reports or details on individual timesheets could provide this information; it is possible that a quality management system (QMS) could be used to sign-off the products of each project module.
Actual costs – it is essential that a timesheet system be in place to record this information

16.What are the advantages and disadvantages of the EVA approach.

The main advantage is that allows non-technical people to get an overall understanding of the progress of a project. It makes clear the interplay between task completion and costs e.g. that a project could be late but under cost because of resource shortages.

Disadvantages include the amount of detail that has to go into planning and costing in the first place. The estimates have to be right in the first place. The approach used here (0/100) hides work that has been done but which has not led to completion of a task – it could genuinely be the case that a task is 99% complete!