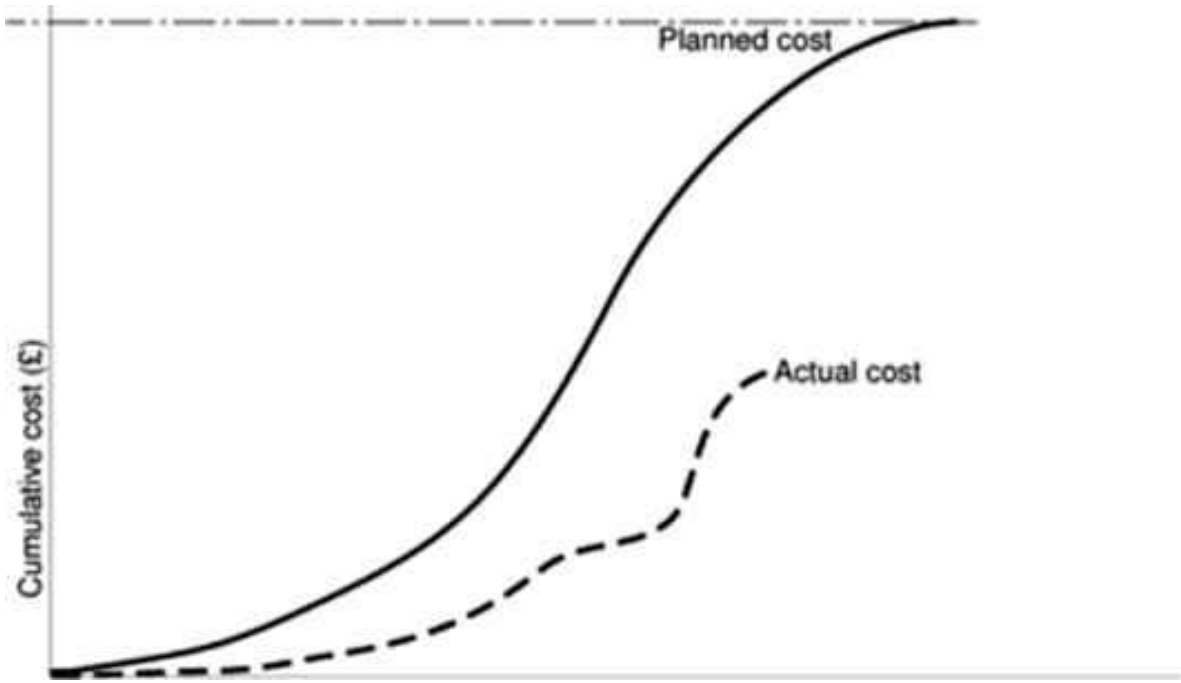
Cost monitoring

Unit4-part-2

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 (or at least been charged to) a project.
- A project might be on time but only because more money has been spent on activities than originally budgeted.
- A cumulative expenditure chart such as that shown in Figure provides a simple method of comparing actual and planned expenditure.



- By itself it is not particularly meaningful - Figure could, for example, illustrate a project that is running late or one that is on time but has shown substantial costs savings!
- Cost charts become much more useful if we add projected future costs calculated by adding the estimated costs of uncompleted work to the costs already incurred.
- Where a computer-based planning tool is used, revision of cost schedules is generally provided automatically once actual expenditure has been recorded.

Earned Value

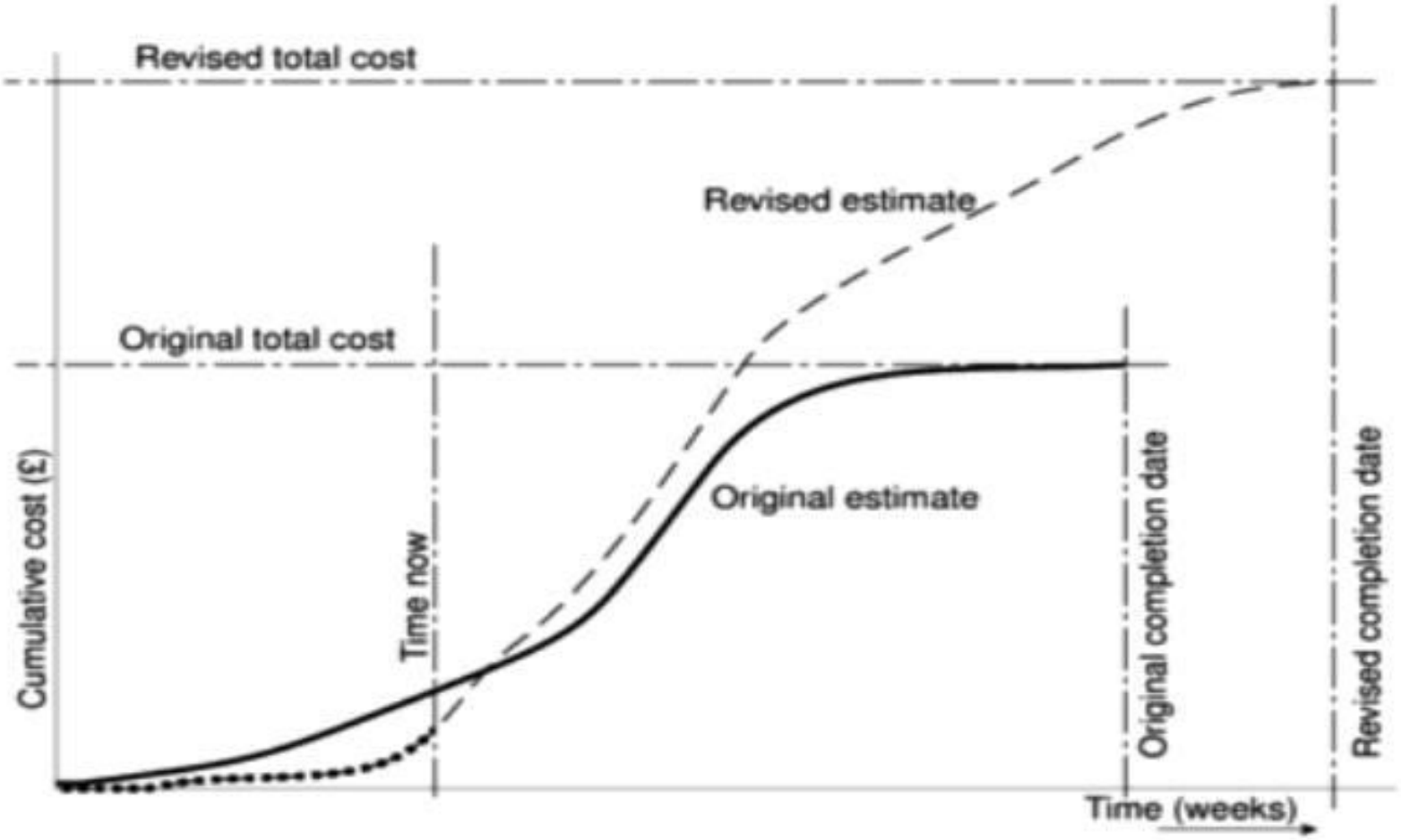
- Earned Value Analysis, also known as Budgeted Cost of Work Performed.
- Earned Value Analysis is based on assigning a 'value' to each task or work package (WBS) based on the original expenditure forecasts.
- The assigned value is the original budgeted cost for the item and is known as the ***baseline budget or planned value or budgeted cost of work scheduled (BCWS).***
- A task that has not started is assigned the value zero and when it has been completed, it, and hence the project, is credited with the value of the task.
- The ***total value credited to a project at any point is known as the earned value or budgeted cost of work performed (BCWP)*** and this can be represented as a value or as a percentage of the BCWS.

Where tasks have been started but are not yet complete, some consistent method of assigning an earned value must be applied. Common methods in software projects are:

- **the 0/100 technique-** Where a task is assigned a value of zero until such time that it is completed when it is given a value of 100% of the budgeted value;
- **the 50/50 technique-** Where a task is assigned a value of 50% of its value as soon as it is started and then given a value of 100% once it is complete;
- **the milestone technique-** Where a task is given a value based on the achievement of milestones that have been assigned values as part of the original budget plan.

Of these, we prefer the 0/100 technique. The 50/50 technique can give a false sense of security by over-valuing the reporting of activity starts. The milestone technique might be appropriate for activities with a long duration estimate but, in such cases, it is better to break that activity into a number of smaller ones.

Cumulative cost expenditure



Baseline budget

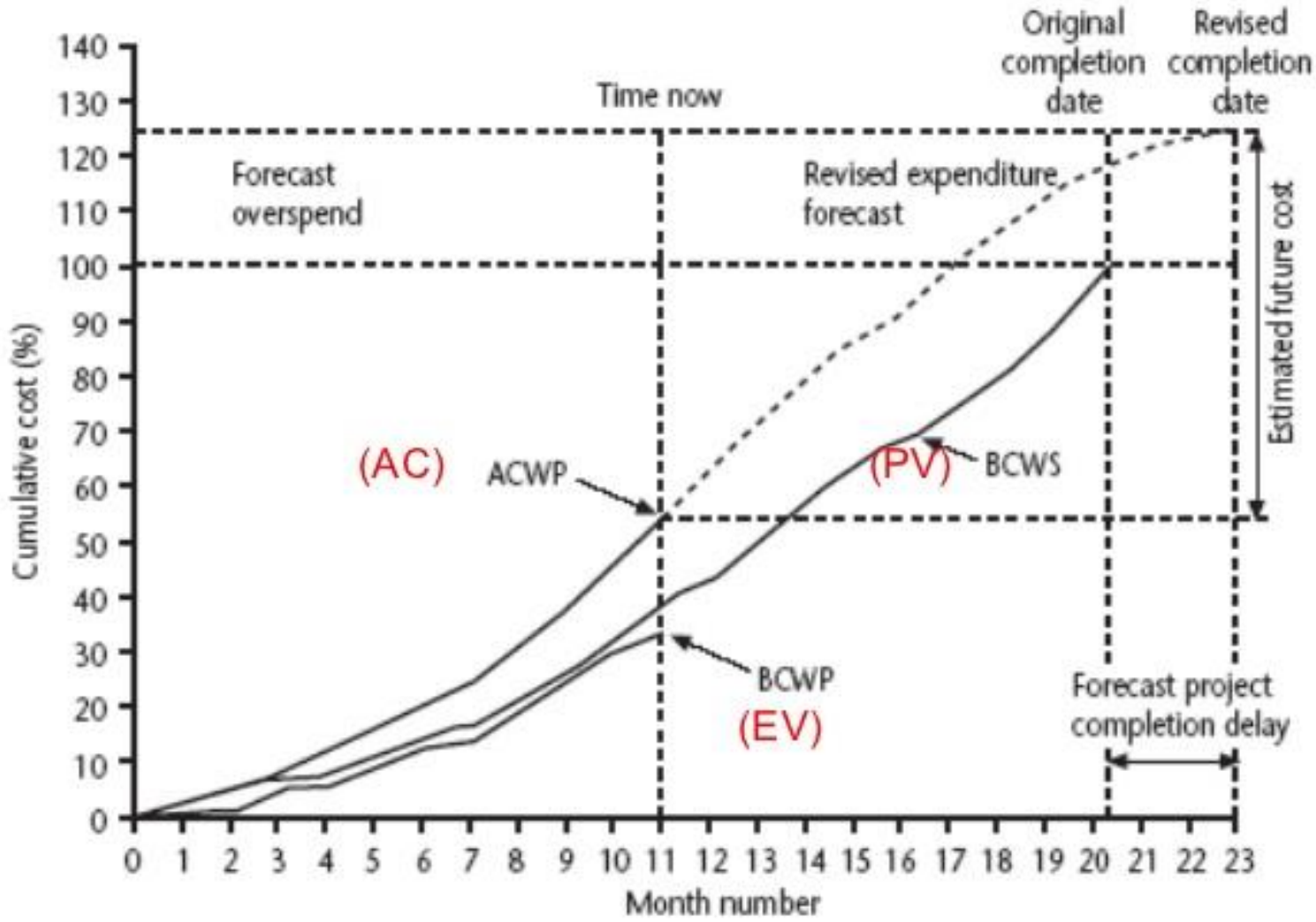
- The first stage in setting up an earned value analysis is to create the baseline budget.
- The baseline budget is based on the project plan and shows the forecast growth in earned value through time.
- Earned value may be measured in monetary values but, in the case of staff-intensive projects such as software development, it is common to measure earned value in person-hours or workdays.

Monitoring earned value

- Having created the baseline budget, the next task is to monitor earned value as the project progresses. This is done by monitoring the completion of tasks (or activity starts and milestone achievements in the case of the other crediting techniques). The actual cost of each task can be collected as actual cost of work performed, ACWP.
- **Budget variance= ACWP - BCWS** and indicates the degree to which actual costs differ from those planned.
- **Schedule variance= BCWP -BCWS** and indicates the degree to which the value of completed work differs from that planned.
- **Cost variance= BCWP - ACWP** 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.
- **Performance ratios-**
    1. **cost performance index (CPI = BCWP/ACWP) and**
    2. **schedule performance index (SPI = BCWP/ BCWS)**

They can be thought of as a 'value-for-money* indices. A value greater than one indicates that work is being 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.

Earned value chart with revised forecasts



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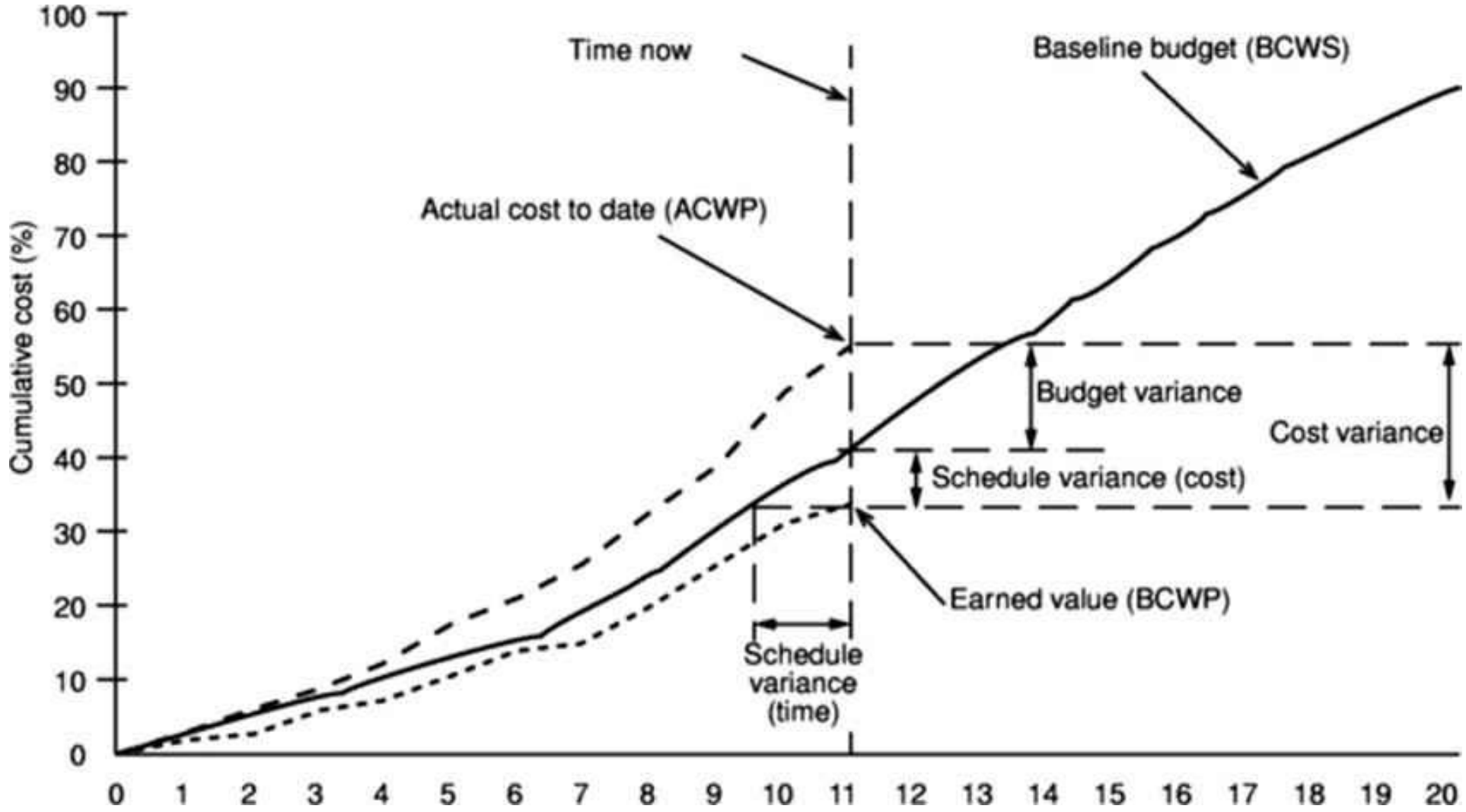
Time now
Baseline budget (BCWS)
Actual cost to date (ACWP)
Budget variance
Cost variance
Schedule variance (cost)
Earned value (BCWP)
Schedule variance (time)
Cumulative cost (%)
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

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) = EV/PV

  i.e 13/19 = 0.68

Earned value analysis – actual cost

- Actual cost (AC) is also known as Actual cost of work performed (ACWP)
- In previous example, if
  - 'Specify module' actually took 3 days (planned 5 days)
  - 'Code module' actually took 4 days (planned 8 days)
- Actual cost = 7 days
- Cost variance (CV) = EV-AC

  i.e. 13-7 = 6 days
- Cost performance indicator (CPI) = EV/AC

  i.e = 13/7 = 1.86
- Positive CV or CPI > 1.00 means project under budget or the work is completed better than planned

Prioritizing monitoring

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

- **Critical path activities-** Any delay in an activity on the critical path will cause a delay in the completion date for the project. Critical path activities are therefore likely to have a very high priority for close monitoring.
- **Activities with no free float** –Free float is the amount of time an activity may be delayed without affecting any subsequent activity. If delayed later dependent activities are delayed
- **Activities with less than a specified float- I**f any activity has very little float it might use up this float before the regular activity monitoring brings the problem to the project manager's attention. It is common practice to monitor closely those activities with less than, say, one week free float.

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- **High risk activities-** A set of high risk activities should have been identified as part of the initial risk profiling exercise. If we are using the PERT three-estimate approach we will designate as high risk those activities that have a high estimated duration variance. These activities will be given close attention because they are most likely to overrun or overspend.
- **Activities using critical resources-** Activities can be critical because they are very expensive (as in the case of specialized contract programmers). Staff or other resources might be available only for a limited period, especially if they are controlled outside the project team. In any event, an activity that demands a critical resource requires a high level of monitoring.

Getting the project back to target

- Almost any project will, at one time or another, be subject to delays and unexpected events. One of the tasks of the project manager is to recognize when this is happening (or, if possible, about to happen) and, with the minimum delay and disruption to the project team, attempt to mitigate the effects of the problem.
- In most cases, the project manager tries to ensure that the scheduled project end date remains unaffected. This can be done by shortening remaining activity durations or shortening the overall duration of the remaining project.
- This might not always be the most appropriate response to disruptions to a plan. There is little point in spending considerable sums in overtime payments in order to speed up a project if the customer is not overly concerned with the delivery date and there is no other valuable work for the team members once this project is completed.
- There are two main strategies to consider when drawing up plans to bring a project back on target –

1. shortening the critical path
2. altering the activity precedence requirements.

1- **Shorten the critical path**

- The overall duration of a project is determined by the current critical path, so speeding up non-critical path activities will not bring forward a project completion date.
- Extolling staff to 'work harder' might have some effect, although frequently a more positive form of action is required, such as increasing the resources available for some critical activity. Fact-finding, for example, might be speeded up by allocating an additional analyst to interviewing users. It is unlikely, however, that the coding of a small module would be shortened by allocating an additional programmer - indeed, it might be counterproductive because of the additional time needed organizing and allocating tasks and communicating.
- Resource levels can be increased by making them available for longer. Thus, staff might be asked to work overtime for the duration of an activity and computing resources might be made available at times when they might otherwise be inaccessible.
- Where these do not provide a sufficient solution, the project manager might consider allocating more efficient resources to activities on the critical path or swapping resources between critical and non-critical activities.

2-**Reconsider the precedence requirements**

- If attempting to shorten critical activities proves insufficient, the next step is to consider the constraints by which some activities have to be deferred pending completion of others.
- Example- The original project network would most probably have been drawn up assuming 'ideal' conditions and 'normal' working practices. It might be that, to avoid the project delivering late, it is now worth questioning whether as yet unstarted activities really do have to await the completion of others. It might, in a particular organization, be 'normal' to complete system testing before commencing user training. In order to avoid late completion of a project it might, however, be considered acceptable to alter 'normal' practice and start training earlier.
- One way to overcome precedence constraints is to subdivide an activity into a component that can start immediately and one that is still constrained as before.