UNIT-4

Project Time Management

Learning Outcomes

By the end of this unit the learner will be able to:

- ✓ Understand the importance of time management in a project
- ✓ Describe project time management techniques.

Unit 4

Project Time Management

Introduction

Adequate time for planning is required for Effective project management. Based on the results of planning, adequate time is required for implementation of those plans. In this unit, we'll discuss how project activities are decomposed and then how the work packages are sequenced, calculated, and accounted for. We'll also discuss the art and science of estimating the time for work packages in new and familiar projects. We'll create and visualize the network diagram once the work's been decomposed.

A project manager must be able to effectively manage time to effectively finish and manage a project. Within a project there can be many factors that affect the project length: project calendars, resource calendars, activity duration, vendors, activity sequencing, and more. Time management begins with the constraints of the product schedule, the project calendar, the resource calendars, as well as the activities and their expected duration.

Many projects can rely on project templates that have worked before. Other projects, new and never-attempted technology, require that a project schedule be created from scratch. The WBS contributes to the activity list. This allows the project manager and the project team to begin activity sequencing. Activities to be sequences must be estimated. The project manager and the project team must evaluate the required time to complete the work packages, and a number of estimating methods can be relied on to come to a predicted duration for activities.

Defining the Project Activities

Projects are temporary undertakings to create a unique product or service. The idea of time is inherent to the very definition of a project in that all projects are temporary. Projects may seem to last forever, but sooner or later they must end. The end date of a project can be predicted by an adequate planning of the temporary project. Within this short, limited time, the project manager must create something: a product or a service. The creation is about change—and change, as you may have guessed, takes time.

Figure 5.1 shows the components of project time management.

Creation of the product or service comes about due to the work the project team completes. The sum of the time of the work equates to when the project is completed.

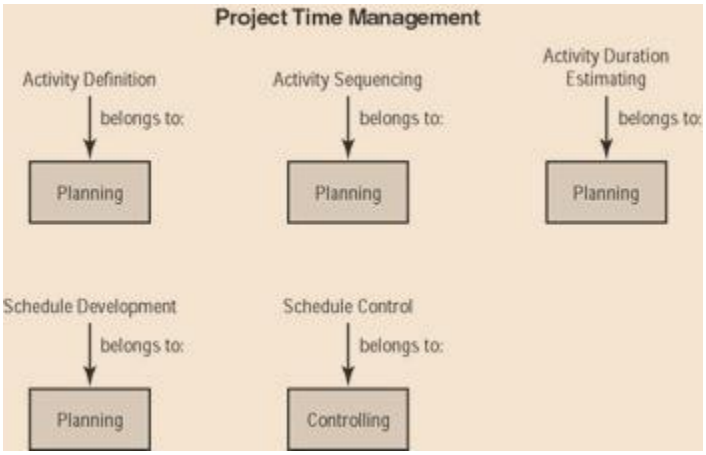

Fig: 4.1 Project time management

In addition to the duration of activities, there are other factors of time to consider:

- Project management activities
- Planning processes
- Procurement
- Reliance on internal and external events
- The sequence of activities
- Known and unknown events affecting the project

Project time management is based predominantly on planning, and then it's all control and execution. Planning for project schedules may stem from deadlines, customer demands, hard and soft logic, and a bit of prediction.

The Inputs to Activity Definition

The activity list is an output of activity definition. It includes all of the activities to be performed within the project. The list must be in alignment with the project scope. Remember that the project scope is a description of all the required work, and only the required work, to complete the project. Since it includes only those actions needed to complete the project scope, the activity list is actually a further definition of the project scope.

Creating the activity list relies on several completed documents, knowledge, and actions. The creation of the activity list uses the following as inputs to the process:

- **WBS** serves as a major input in the creation of the activity list. The WBS is a deliverables-orientated collection of project components. It is not a collection of activities to create the deliverables.
- **Scope statement** is a description of the required work, and only the required work, to complete the project.

- **Historical information** is proven information that the project manager can rely on for creating activity lists.
- **Expert judgment** Expert judgment allows experts to influence decisions in regard to the needed work packages.
- **Assumptions** What assumptions have been identified for the project work? For example, consider the availability of resources, acceptable weather, and time allotments to complete the project.
- **Constraints** What restrictions are imposed on the project manager and the project team? For example, is there a deadline for the project? Demanded quality metrics? A predetermined budget? These are examples of constraints.

Decomposing the Project Work Packages

The WBS, the collection of deliverable-orientated components, must now be broken into activities. Specifically the work packages within the WBS must be decomposed into manageable work elements. What's the difference between decomposing the project deliverables and the project work? The elements in the WBS are deliverables; this process is concerned with the actions needed to create the deliverables. It's quite possible to create the WBS and the activity list in tandem. Don't get too caught up in the timing of the activity list definition and the WBS. Simply put, the activity list defines the actions to create the deliverables; the WBS describes the components of the deliverables.
A project manager can use a template from the previous project for this. A template can include several elements to make a project manager's life easier and the new project more successful:

- Required resources and skills
- Required actions to complete the project scope
- Known risks
- Outputs of the work
- Required hours of duration for activities
- Supporting details
- Descriptions of the work packages

Compiling the activity list comes next. The activity list also ensures that there is no extra work included in the project. Extra work costs time and money—and defeats the project scope. The activities list is comprised of all of the work required to create the components within the WBS.

Supporting Details Consideration

The supporting detail of the activity list must be documented, organized for fast reference, and accessible throughout the project implementation. The supporting detail allows the project team, the project manager, and other interested parties to reference the activity list definition process and recall why decisions were made and how the activity list was created. The supporting detail includes;

- Constraints
- Reasoning behind identified work package
- Information specific to the industry that the project is operating within
- Assumptions

Mapping the Activities

After the activity list has been created, the activities must be arranged in a logical sequence. This can be accomplished a few different ways:

1. **Manual process** In smaller projects, and on larger projects in the early phases, manual sequencing may be preferred. An advantage of manual sequencing is that it's easier to move around dependencies and activities than in some programmes.
2. **Computer driven** There are many different scheduling and project management software packages available. These programs can help the project manager and the project team determine which actions need to happen in what order—and with what level of discretion.
3. **Blended approach** A combination of manual and computer-driven scheduling methods is fine. However, it's important to determine the finality of the activity sequence. Sometimes a blended approach can be more complex than relying on just one or another.

Inputs to Activity Sequencing

There are many approaches to completing the activity sequencing. Perhaps the greatest approach is that activity sequencing is done not as a solo activity, but with the project team instead. The project manager must rely on the project team and the inputs to activity sequencing:

- **Activity list** The activity list we've just discussed—it's the list of actions needed to complete the project deliverables.
- **Product description** The product description is needed since it may influence the sequence of events. For example, in construction, technology, or community planning (among other project types), the product description may include requirements that will logically affect the planning of activity sequencing.
- **Mandatory dependencies** These dependencies are the natural order of activities. These relationships are called hard logic. For example, you cannot begin building your house until your foundation is in place.
- **External dependencies** As its name implies, these are dependencies outside of the project's control. Examples include delivery of equipment from a vendor, the deliverable of another project, or the decision of a lawsuit, committee, or expected new law.

- **Discretionary dependencies** These dependencies are the preferred order of activities. Discretionary dependencies allow activities to happen in a preferred order because of best practices, conditions unique to the project work, or external events. Project managers should use these relationships at their "discretion" and document the logic behind the decision. For example, a painting project typically allows the primer and the paint to be applied within hours of each other. Due to the expected high humidity during the project, however, all of the building will be completely primed before the paint can be applied. These relationships are also known as soft logic, preferred logic, or preferential logic.
- **Milestones** Milestones must be considered and evaluated when sequencing events to ensure all of the work needed to complete the milestones is included.

Creating Network Diagrams

Network diagrams visualize the project work. A network diagram shows how the work will progress from start to completion and the relationship of the work activities. Network diagrams can be extremely complex or easy to create and configure. Most network diagrams in today's project management environment use an approach called "activity on- node" to illustrate the activities and the relationship between activities. Older network diagramming methods used "activity-on-arrows" to represent the activities and their relationships.

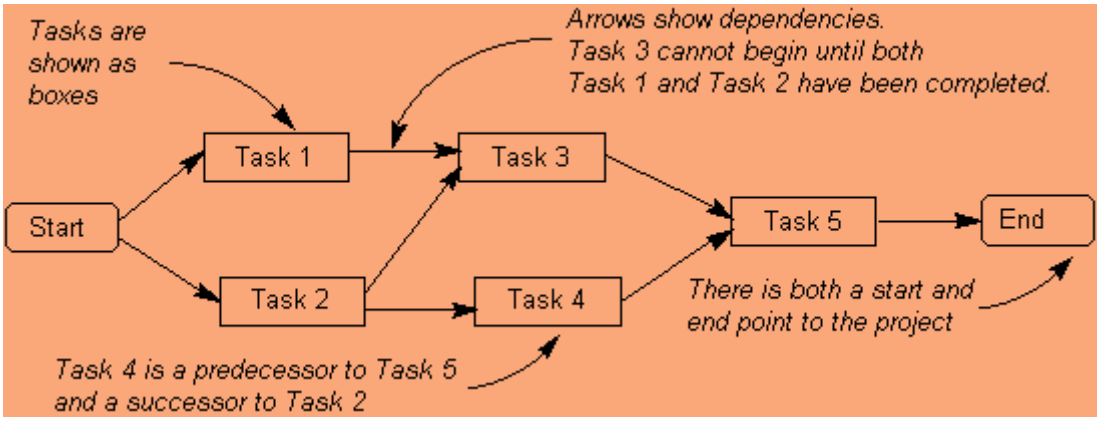

Fig: 4.2

Using the Precedence Diagramming Method

The most common method of arranging the project work visually is The Precedence Diagramming Method (PDM). The PDM puts the activities in boxes, called nodes, and connects the boxes with arrows. The arrows represent the relationship and the dependencies of the work packages. The following illustration shows a simple network diagram using PDM.

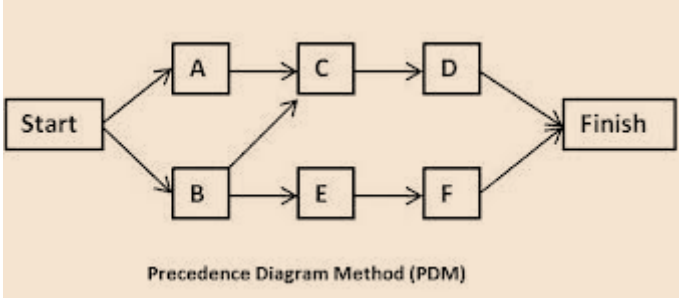

Fig: 4.3

- **Start-to-start (SS)** This relationship means Task A must start before Task B can start. This relationship allows both activities to happen in tandem. For example, a crew of painters is painting a house. Task A is to scrape the flecking paint off the house and Task B is to prime the house. The workers scraping the house must start before the other workers can begin priming the house. All of the scraping doesn't have to be completed before the priming can start, just some of it.
- **Finish-to-start (FS)** This relationship means Task A must complete before Task B can begin. This is the most common relationship. The foundation must be set before the framing can begin, for example.
- **Finish-to-finish (FF):** This relationship means Task A must complete before Task B does. Although this is not always the case, ideally, two tasks must finish at exactly the same time. For example, two teams of electricians may be working together to install new telephone cables throughout a building by Monday morning. Team A is pulling the cable to each office. Team B is connecting the cables to wall jacks and connecting the telephones. Team A must pull the cable to the office so Team B can complete their activity. The activities need to complete at nearly the same time, by Monday morning, so the new phones are functional.
- **Start-to-finish (SF)**This relationship is also known as just in-time (JIT) scheduling. It is unusual and is rarely used. It requires that Task A start so that Task B may finish. Such relationships may be encountered in construction and manufacturing. An example is a construction of a shoe store. The end of the construction is soon, but an exact date is not known. The owner of the shoe store doesn't want to order the shoe inventory until the completion of the construction is nearly complete. The start of the construction tasks dictates when the inventory of the shoes is ordered.
- **Using the Arrow Diagramming Method**

  The Arrow Diagramming Method (ADM) approach to activity sequencing uses arrows to represent the activities. The arrows are "connected" on nodes. ADM only uses finish-to start relationships.

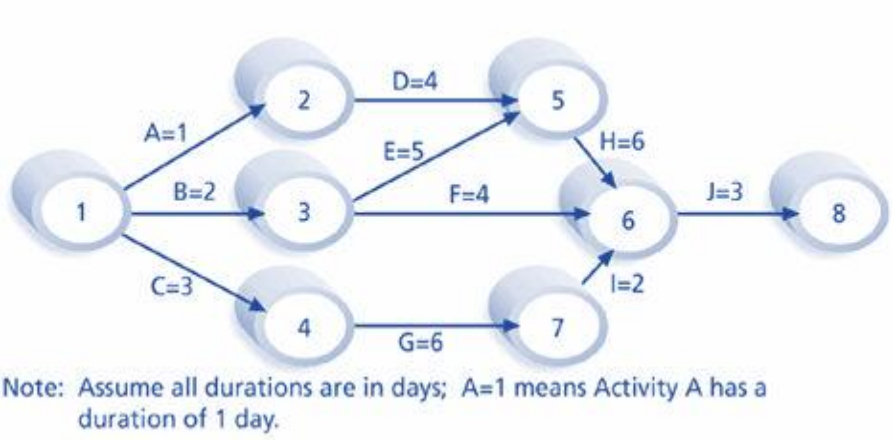

Fig: 4.4

Examining the Sequencing Outputs

There are many approaches to using activity sequencing: a project manager and the project team can use software programs, the approach can be done manually, or the team can manually do the scheduling and then transfer the schedule into a PMIS.

Whichever method is selected, the project manager must remember four things:

- Only the required work should be scheduled.
- Activity sequencing is not the same as a schedule.
- Finish-to-start relationships are the most common and preferred.
- Scheduling comes after activity sequencing.

Using a Project Network Diagram

The flow of the project work can be visualized after the activity list has been put into sequential order. A project network diagram (PND) illustrates the relationship between the work packages and the flow of the project work.

Assumptions about the activity sequence may reveal missing activities in the activity list during the creation of the network diagram. Just as the creation of the activity list may prompt the project team and the project manager to update the WBS, the creation of the network diagram may prompt the project team to update the activity lists. Although it may seem redundant to update the activities list illustrated in the project network diagram, it is essential documentation. The activity list, a reflection of the WBS, and the network diagram should all support the project scope. A key stakeholder should be able to follow the logic of the WBS to the activity list, and from the activity list find all of the activities mapped in order.

Estimating Activity Durations

Creating honest estimates based on the provided, is the best a project manager can do. No one will know the duration of the project until the schedule is finalized. The tasks are first identified, their duration is estimated, and then the sequencing of the activities takes place. These three activities are iterated as more information comes available, and are required to complete the project schedule and the estimated project duration. The project can move forward if the proposed schedule is acceptable. If the proposed schedule

takes too long, the scheduler can use a few strategies to compress the project. We'll discuss the art of sequencing in a few moments.

Activity duration estimates, like the activity list and the WBS, don't come from the project manager—they come from the people completing the work. Activity duration estimates may undergo progressive elaboration. We will examine the approach to completing activity duration estimates, the basis of estimates, and allow for activity list updates in this section.

Consider the Activity Duration Estimates Inputs

The importance of accurate estimates is paramount. The activity estimates will be used to create the project schedule, and predict when the project should end. Inaccurate estimates could cost the performing organization thousands of dollars in fines, loss of customers, lost opportunities, or worse. To create accurate estimates, the project manager and the project team will rely on several inputs:

- **Activity lists** Activity lists are the work elements necessary to create the deliverables.
- **Assumptions** An identification of the assumptions is needed since work estimates may be influenced by the assumptions. For example, the team may be operating under an assumption that the project must be completed within one calendar year.
- **Constraints** An identification of the project constraints is needed since they may influence the estimates. A deadline is an example of a constraint.
- **Resource requirements** Activity durations may change based on the number of resources assigned to the activity. For example, Task A may take eight hours with one person assigned to the work, but Task A may be completed in four hours with two team members assigned. Some activities, will take the same amount of time regardless of how many resources are assigned, for example, installing a computer operating system. Project managers must also take care not to overload resources in an effort to complete a task, since too many resources can be counterproductive.
- **Resource capabilities** The abilities of the project team members must be taken into consideration. Consider a task in an architectural firm. Reason says that if a senior architect is assigned to the task, he will be able to complete it faster than if a junior architect were assigned to the same task. Also consider material resources to influence activity time. Consider pre-drilled cabinets versus cabinets that require the carpenter to drill each cabinet as it is installed. The pre-drilled cabinets allow the job to be completed faster.
- **Duration vs. Effort** Duration is how long the task is expected to take with the given amount of labour. Effort is the amount of labour that is applied to a task. For example, a task to unload a freight truck may take eight hours with two people assigned to the task. If the effort is increased by adding more labour to the task (in this instance, more people), then the duration of the task is decreased. Some activities, however, have a fixed duration and are not affected by the amount of labour assigned to the task. For example, to install a piece of software on a computer will take the

same amount of time if one computer administrator is completing the work or if two computer administrators are attempting to complete the work.

- **Historical information** Historical information is always an excellent source for information on activity duration estimates. Historical information can come from several sources:
  - Historical information can come from project files of other projects within the organization.
  - Project team members may recollect information regarding the expected duration of activities. While these inputs are valuable, they are generally less valuable than documented sources such as other project files or the commercial databases.
  - Commercial duration estimating databases can offer information on how long industry-specific activities should take. These databases should take into consideration the experience of the resources, the materials, and define the assumptions the predicted work duration is based upon.

Risk Identification

The risks on each activity should be identified, analysed, and then predicted as to their probability and impact. If risk mitigation tasks are added to the schedule, the mitigation activities will need their duration estimated and then sequenced into the schedule in the proper order.

Expert Judgment

If possible, expert judgment should be utilized by the project manager and the project team to predict the duration of project activities. Expert judgment can come from subject matter experts, project team members, and other resources, internal or external to the performing organization that is familiar with the activities the project demands. As there are many variables that can influence an activity's duration, estimating durations is not easy. Consider the amount of resources that can be applied to the resources, the experience of the resources completing this type of work, and their competence with the work packages.

Evaluation of the Estimates

The end result of estimating activities provides three things:

- **Activity duration estimates** reflect how long each work package will take to complete. Duration estimates should include an acknowledgement of the range of variance. For example, an activity whose duration is expected to be one week may have a range of variance of one week ± three days. This is assuming a week is five days and means the work can take up to eight days, or as little as two days.
- **Basis of estimates** Any assumptions made during the activity estimating process should be identified. In addition, any historical information, subject matter experts, or commercial estimating databases that were used should also be documented for future reference.

Activity list updates there may be discoveries of missing activities within the activity list during the estimating process. The project manager should confirm that the new work packages are reflected in the activity list for the project.

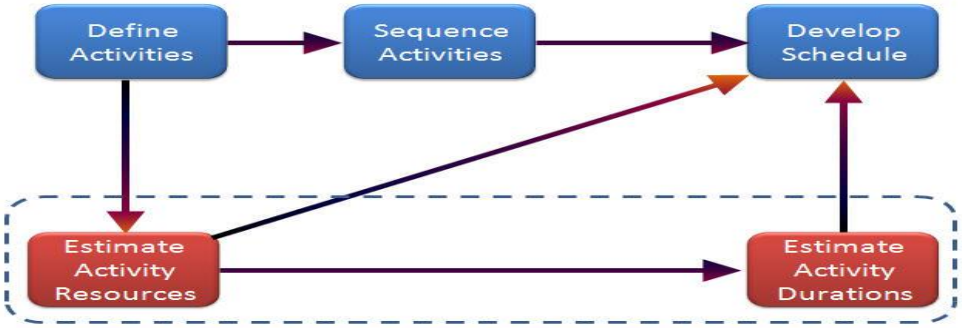

Fig: 4.5:

Developing the Project Schedule

Now that the estimates for the activities are completed, let's see how long the entire project will take. The project manager specifically pursues the start date, and more importantly, the completion date. Projects aren't likely to get approved, if don't provide realistic schedules. Or worse, the projects will get approved, but they will most likely fail, as the project team will not be able to meet the unrealistic schedule.

The creation of the project schedule is iterative. Although on smaller projects it may be possible, it's rare for a schedule to get created, approved, and implemented without some iterative examination, arrangement, and management input. When activity list updates, constraints, assumptions and other inputs are considered, it's easy to see why scheduling can become complex.

Revisiting the Project Network Diagram

Recall that the PND shows the sequence of activities and the relationship between activities. The PND is important during schedule creation because it allows the project manager and the project team to evaluate the decisions, constraints, and assumptions that were made earlier in the process and helps them determine why certain activities must occur in a particular order.

Considering the Resource Requirements

The project schedule will be affected by the identified resource requirements. Remember the difference between duration and effort? Duration is how long the activity will take, effort is the labour applied to the task. For example, painting a building may take 80 hours to complete with two workers assigned to the job. Add two more workers and now the work will take only 40 hours.

Considering the Resource Pool Availability

If you were living In a perfect world, all of the needed resources for a project would be available whenever the project manager says so. In the real world, and on your PMP exam, the availability of project resources fluctuate due to demands of other projects, demands of on-going operations, vacations, sick days, personal lives, and more. The availability of the project pool must be evaluated. If certain activities require

a worker with a highly specialized skill, these activities are resource-dependent. Should the worker not be available for the timeframe of the required activity, one of several things must happen:

- The activity must be moved in the schedule for when the resource is available.
- The project manager must negotiate to make the resource available for the activity in the project schedule.
- The project may incur additional costs by finding other resources to complete the scheduled work.
- The activity, and possibly the project, must wait for the resource to become available.

Considering the Calendars

There are two calendar types that will affect the project:

- **Resource calendar** The resource calendar controls when resources, such as project team members, consultants, and SMEs are available to work on the project. It takes into account other commitments within the organization, vacations, or restrictions on contracted work, overtime issues, and so on.
- **Project calendar** This calendar shows when work is allowed on the project. For example, a project may require the project team to work nights and weekends so as not to disturb the on-going operations of the organization during working hours. Additionally, the project calendar accounts for working hours, holidays, and work shifts that the project will cover.

Evaluating the Project Constraints

Constraints will restrict when and how the project may be implemented. Constraints are added to a project for a purpose, not just to rush the work to completion. It is important to understand why the constraint has been imposed. Here are a few common examples of why constraints exist:

- To take advantage of an opportunity to profit from a market window for a product or service.
- To work within the parameters of expected weather conditions (for seasonal or outdoor projects).
- To adhere to industry regulations, best practices, or guidelines.
- To work within timeframes that incorporates the expected delivery of materials from vendors or other projects. Perhaps one of the biggest constraints is the predetermined project deadline.
- To adhere to government requirements.
- Imagine a company creating a product to take to a tradeshow. If the creation of the product is running late, the tradeshow isn't going to move so that the product has enough time to be completed for the show. There are four time constraints to consider:

a) **Start No Earlier Than (SNET)** This constraint requires that the project or activity not start earlier than the predetermined date. Consider an activity to add software to an existing network server in a technology project. If the project manager adds a "Start No Earlier Than" constraint on the activity to ensure the activity begins on a Saturday when the server is not in use by the organization, then the activity can begin any time after the pre-set date, but not before it.

b) **Finish No Earlier Than (FNET)** This somewhat unusual constraint requires the activity to be in motion up until the predetermined date. Consider a project to create a special blend of wine. The wine must be aged a specific amount of time before the winemaking process can continue; the process requires a set amount of time so it may "Finish No Earlier Than" the determined time. The activity can end any time after the pre-set date, but not before it.

c) **Start No Later Than (SNLT)** This constraint requires the activity to begin by a predetermined date. For example, the creation of a community flower garden must "Start No Later Than" April 20. The creation of the garden may, weather permitting, begin earlier than the pre-set date, but it must start by that date.

d) **Finish No Later Than (FNLT)** This constraint requires the project or activity to finish by a predetermined date. For example, the installation of flooring tile in a restaurant must be finished by September 10 so the kitchen equipment can be installed. The constraint "Finish No Later Than" is tied to the date of September 10. The activity can end sooner than September 10, but not after it.

Evaluating the Risk Management Plan

A risk in the project may be identified as delays from the vendor for the equipment needed to complete the project. If a risk happens, the response to this risk may be to secure an alternate vendor that charges slightly more for the same equipment but has it in stock. The delay of the equipment with the original vendor may throw the project off schedule, and the additional time to find, purchase, and ship the needed equipment could also add extra time to the project.

Creating the Project Schedule

To create a feasible schedule for the project, the project manager, the project team, and possibly even the key stakeholders, will examine the previously discussed inputs, and apply the techniques discussed in this section. Creating the project schedule is part of the planning process group. It is calendar based and relies on the project network diagram and the accuracy of time estimates. The point of the project schedule is to complete the project scope in the shortest amount of time possible without incurring exceptional costs, risks, or a loss of quality.

Updating the Project Schedule

What happens when a schedule change occurs? The project manager must ensure that the project schedule is updated to reflect the change. He must document the change and follow the guidelines within the schedule management plan. Any formal processes, such as notifying stakeholders or management, should be followed.

Revisions are a special type of project schedule change, which cause the project start date, and more likely, the project end date to be changed. They typically stem from project scope changes. Additional time is needed to complete the project Because of the additional work the new scope requires.

Schedule delays, for whatever reason, may be so drastic that the entire project has to be rebase lined. Rebase lining is a worst-case scenario and should only be used when adjusting for drastic, long delays. All of the historical information up to the point of the rebase line is eliminated when rebase lining happens. Schedule revision is the most common and preferred approach to changing the project end date.

Applying Corrective Action

Any method applied to bring the project schedule back into alignment with the original dates and goals for the project end date is called corrective action. Corrective actions are efforts to ensure future performance meets the expected performance levels. It includes:

- Implementing measures to recover from schedule delays
- Extraordinary measures to ensure work packages complete with as little delay as possible
- Root-cause analysis of schedule variances
- Extraordinary measures to ensure work packages complete as scheduled

Recording the Lessons Learned

Lessons learned on creating the schedule, changes to the project schedule, and response to variances are needed as part of the project's historical information. Recall that lessons learned documentation happens not just at the conclusion of the project, but throughout the project plan.

Further Reading:

- ✓ ***Richard Walsh, (2008), Time Management: Proven Techniques for Making Every Minute Count***
- ✓ ***Patrick Forsyth, (2013), Successful Time Management***
- ✓ ***Alec Mackenzie, Pat Nickerson, (2009), The Time Trap: The Classic Book on Time Management***