UNIT-6

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 6

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 the implementation of those plans. In this unit, we will discuss how project activities are decomposed and how the work packages are sequenced, calculated, and accounted for. We will also discuss the art and science of estimating the time required for work packages in new and familiar projects. We will create and visualize the network diagram once the work has been decomposed.

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

Many projects may rely on project templates that have proved successful in the past. Other projects, perhaps using 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 project team to begin activity sequencing. Activities that will form 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 used to predict the duration of activities.

Defining the Project Activities

Projects are temporary undertakings to create a unique product or service. The idea of time is inherent in 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 the 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 6.1 shows the components of project time management.

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

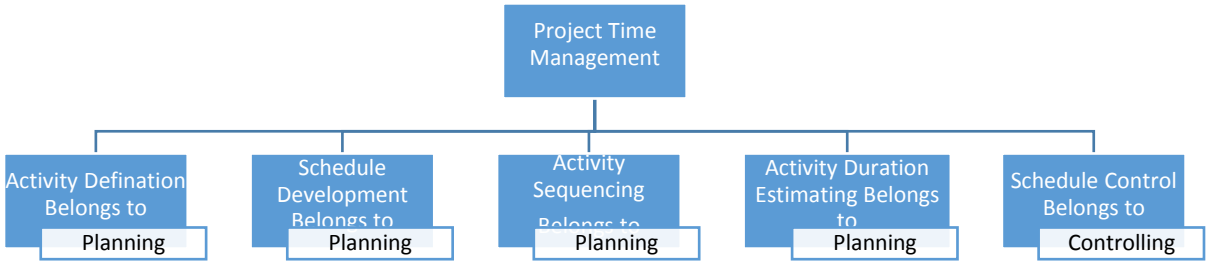

Fig. 6.1 Project Time Management

In addition to the duration of activities, there are other time factors 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, after which it is a matter of control and execution. Planning for project schedules may stem from deadlines, customer demands, hard and soft logic, and a small measure 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 work required, and only the work required, 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 work required, and only the work required, to complete the project.

- **Historical information**is proven information on which the project manager can rely to create activity lists.
- **Expert judgement:**Expert judgement allows experts to influence decisions in regard to the required work packages.
- **Assumptions:**What assumptions have been identified for the project work? For example, consider the availability of resources, acceptable weather, and time allotted for completion of the project.
- **Constraints:**What restrictions are imposed on the project manager and the project team? For example, is there a deadline for the project? Required 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 up into activities. Specifically, the work packages within the WBS must be decomposed into manageable work elements. What is 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 is quite possible to create the WBS and the activity list in tandem. Try not to become too preoccupied with the timing of the activity list definition and the WBS. Simply put, the activity list defines the actions needed to create the deliverables; the WBS describes the components of the deliverables.

A project manager might use a template from a previous project for this purpose. A template might 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 moneyand defeats the project scope. The activities list comprises 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 quick 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 within which the project is operating
- 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 several 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 is easier to move around dependencies and activities than in some programs.
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 acceptable. However, it is important to determine the finality of the activity sequence. Sometimes a blended approach can be more complex than relying on just one.

Inputs to Activity Sequencing

There are many approaches to completing the activity sequencing. Perhaps the best approach is to undertake activity sequencing not as a solo activity but with the project team as a whole. The project manager must rely on the project team and the inputs to activity sequencing:

- **Activity list:** The activity list, as we have just discussed, is the list of actions needed to complete the project deliverables.
- **Product description:** The product description is required 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 foundations are in place.
- **External dependencies:** As the name implies, these are dependencies beyond 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 take place 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, the entire 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 that 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 relationships 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 relationships between activities. Older network diagramming methods used "activity-on-arrows" to represent the activities and their relationships.

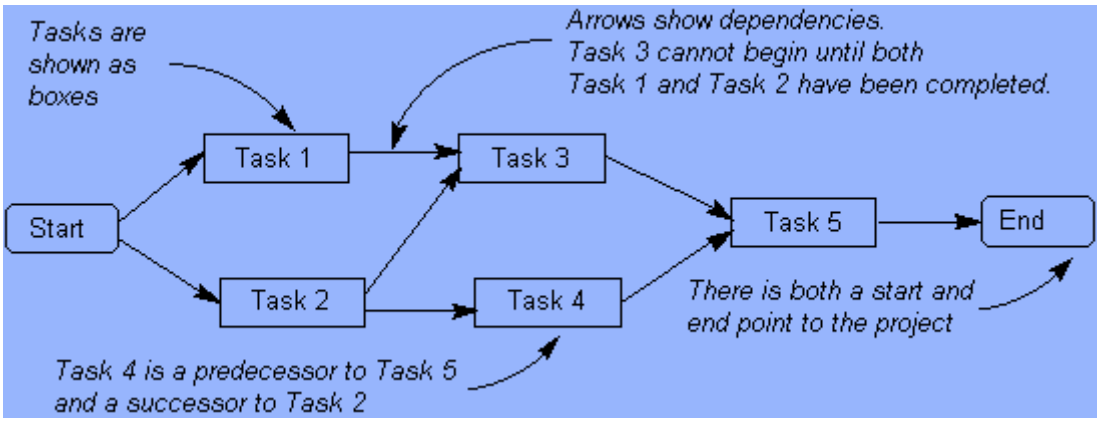

Fig: 6.2

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 relationships and the dependencies of the work packages. The following illustration shows a simple network diagram using PDM.

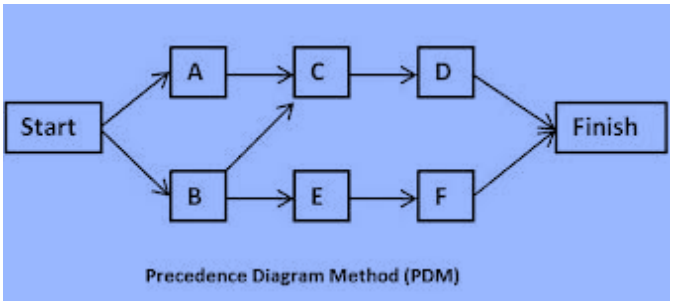

Fig: 6.3

- **Start-to-start (SS):**This relationship means that Task A must start before Task B can start. This relationship allows both activities to occur 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. Not all of the scraping necessarily needs to be completed before the priming can start - just some of it.
- **Finish-to-start (FS):**This relationship means that Task A must be completed 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 that Task A must be completed before Task B is completed. 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 cables to each office. Team B is connecting the cables to wall jacks and connecting the telephones. Team A must pull the cables to the office in order that Team B might complete their activities. The activities need to be completed at nearly the same time, by Monday morning, to ensure that 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 be startedin order that Task B might finish. Such relationships may be encountered in construction and manufacturing. An example is the construction of a shoe store. The end of the construction is imminent, but the exact date is not

known. The owner of the shoe store doesn't want to order the shoe inventory until the construction is nearly complete. The start of the construction tasks dictates when the shoe inventory 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" to nodes. ADM only uses finish-to start relationships.

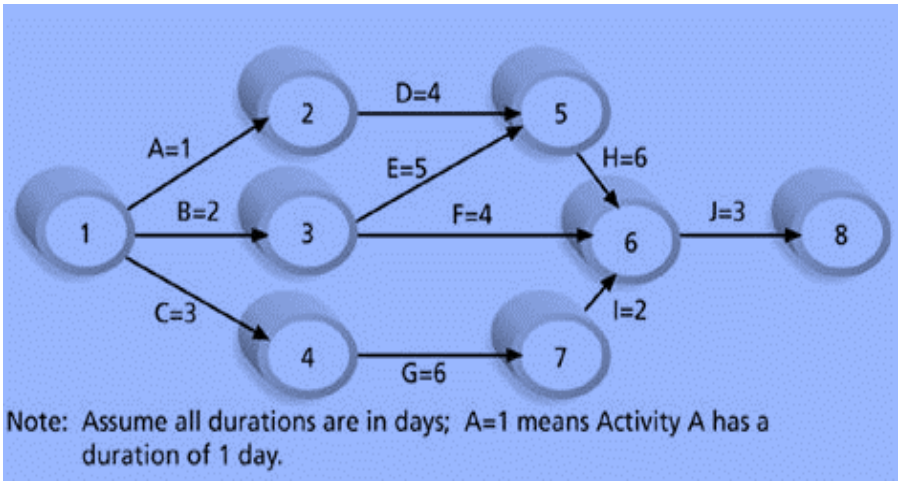

Fig: 6.4

Examining the Sequencing Outputs

There are many approaches to using activity sequencing: a project manager and the project team might use software programs, the approach can be done manually, or the team mightcarry out the scheduling manually 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 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 all the information 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 becomes available, and they 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 might use various strategies to compress the project. We will discuss the art of sequencing shortly.

Activity duration estimates, like the activity list and the WBS, do not come from the project manager—they come from the people completing the work. Activity duration estimates may undergo progressive elaboration. In this section we will examine the approach to completing activity duration estimates, forming the basis of estimates, and allowing for activity list updates.

Considering the Activity Duration Estimates Inputs

Accurate estimates are of paramount importance. 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 dictates that if a senior architect is assigned to the task, he/she will be able to complete it faster than a junior architect would be capable of doing. Also consider how material resources may 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 refers to 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, the task of unloading 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, installing a piece of software on a computer will take the same amount of time regardless of whether one or two computer administratorsis/are attending to the task.
- **Historical information:** Historical information is always an excellent source of 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 recall information on 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 and materials and define the assumptions upon which the predicted work duration is based.

Risk Identification

The risks associated with each activity should be identified, analyzed, and then predicted in terms of their probability and impact. If risk mitigation tasks are added to the schedule, their durations will need to be estimated before they are sequenced into the schedule in the proper order.

Expert Judgment

If possible, expert judgement should be utilized by the project manager and the project team to predict the duration of project activities. Expert judgement may come from subject matter experts, project team members, and other resources, internal or external to the performing organization, who are familiar with the activities demanded by the project. As there are many variables that might influence an activity's duration, estimating durations is not easy. Consider the amount of resources that might be applied to

the work, the experience of the people 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 assumes that 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: Some activities may be discovered to have been omitted from 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.

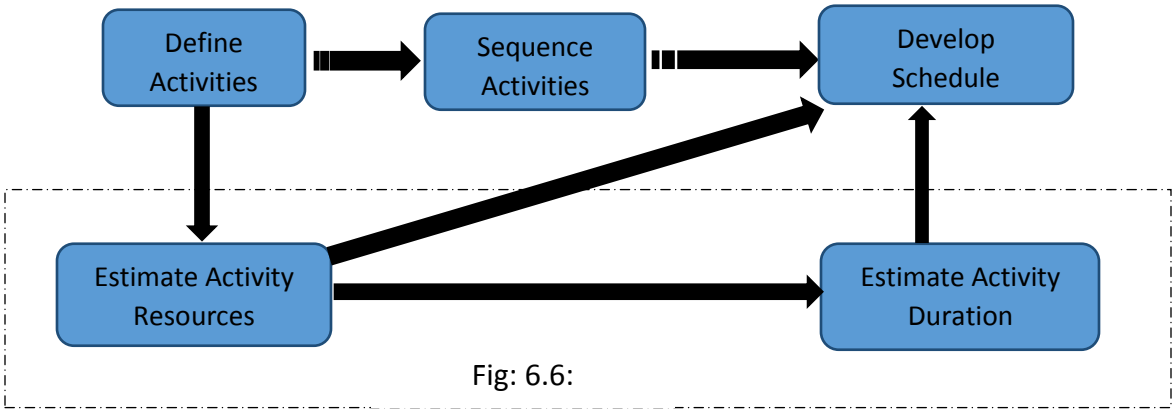

Fig: 6.6:

Developing the Project Schedule

Now that the estimates for the activities have been completed, let us examine how long the entire project will take. The project manager specifically pursues the start date, and more importantly, the completion date. Projects are unlikely to be approved if they donot provide realistic schedules. Worse still, the projects may be approved but will probably fail, as the project team will be unable to meet the unrealistic schedule.

The creation of the project schedule is iterative. With the exception of a few smaller projects, it is rare for a schedule to be created, approved and implemented without some iterative examinations,

arrangements and management inputs. When activity list updates, constraints, assumptions and other inputs are considered, it is 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. Let us recall the difference between duration and effort. Duration refers to how long the activity will take, while 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. With the addition of two more workers, the task will take only 40 hours.

Considering the Resource Pool Availability

In a perfect world, all the resources required for a project would be available at the project manager's command. In the real world, and in your PMP exam, the availability of project resources fluctuate due to the demands of other projects and 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 be unavailable for the timeframe of the required activity, one of several things must happen:

- The activity must be moved in the schedule to a time 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 engaging 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 types of calendar 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, etc.
- **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 in order to avoid

disturbingthe on-going operations of the organization during working hours. Additionally, the project calendar accounts for working hours, holidays, and work shifts covered by the project.

Evaluating the Project Constraints

Constraints will restrict when and how the project might be implemented. Constraints are imposed on 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 incorporating 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 will not be postponed simply to allow the product enough time for completion for the show. There are four time constraints to consider:

a) **Start No Earlier Than (SNET)** This constraint requires the project or activity to start no earlier than the predetermined date. Consider an activity to add software to an existing network server in a technology project. If the project manager places a “Start No Earlier Than” constraint on the activity to ensure that the activity begins on a Saturday when the server is not in use by the organization, then the activity might 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 for a specific amount of time before the winemaking process can continue; the process requires a set amount of time in order that it may “Finish No Earlier Than” the determined time. The activity might 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 tiles in a restaurant must be finished by September 10 in order for the kitchen equipment to be installed. The constraint “Finish No Later Than” is tied to the date of September 10. The activity might end sooner than September 10, but not after it.

Evaluating the Risk Management Plan

An example of a risk to the project is a delay by the vendor in sending the equipment needed to complete the project. If a risk occurs, the response to this risk may be to secure an alternative vendor who charges slightly more for the same equipment but has it in stock. The original vendor's delay in sending the equipment may throw the project off schedule, and the additional time needed to find, purchase and ship the required equipment may 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 one of the planning process group's tasks. It is calendar-based and relies on the project network diagram and the accuracy of the 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/she 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, causing 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 required by the new scope.

Schedule delays, for whatever reason, may be so drastic that the entire project has to be rebaselined. Rebaselining 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 rebaselining is eliminated when rebaselining occurs. 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 that future performance meets the expected performance levels. They include:

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

Recording the Lessons Learned

Lessons learned on creating the schedule, changes to the project schedule, and response to variances are required as part of the project's historical information. Recall that 'lessons learned' documentation is compiled 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***