

# 05. Project Execution, Monitoring & Control:

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## 5.1 Executing Projects:

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- 5.1.2 Information needs and reporting,
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## 5.1 Executing Projects:

The Executing Process Group consists of those processes performed to complete the work defined in the project management plan to satisfy the project requirements. This Process Group involves coordinating resources, managing stakeholder engagement, and integrating and performing the activities of the project in accordance with the project management plan.

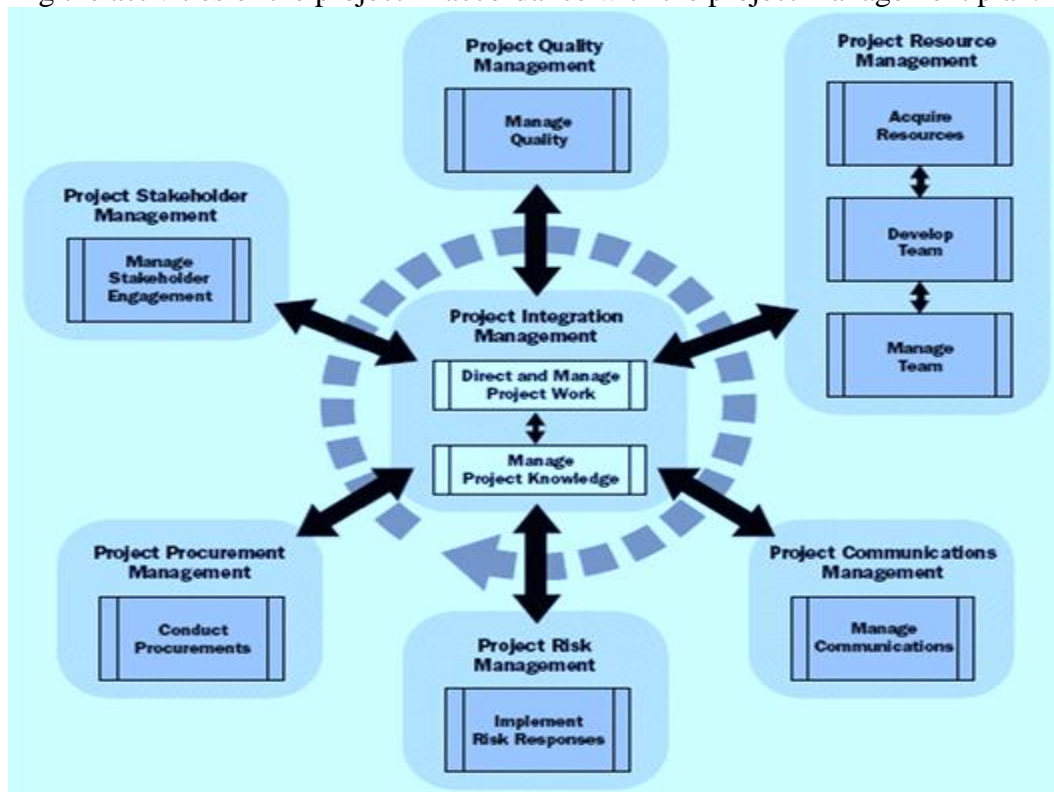


Fig. 5.1 Executing process Group

The key benefit of this Process Group is that the work needed to meet the project requirements and objectives is performed according to plan. A large portion of the project budget, resources, and time is expended in performing the Executing Process Group processes. The processes in the Executing Process Group may generate change requests. If approved, the change requests may trigger one or more planning processes that result in a modified management plan, project documents, and possibly new baselines. The Executing Process Group (Figure 5.1) includes the project management processes.

### 5.1.1 Planning, monitoring and controlling cycle:

Project Management needs to plan, check on progress, compare progress to the plan, and take corrective action if progress does not match the plan. The key things to be planned, monitored, and controlled are time (schedule), cost (budget), and scope (performance). These, after all, encompass the fundamental objectives of the project. And therefore, the planning–monitoring–controlling cycle should be the normal way of life in the parent organization.

-**The planning** (budgeting and scheduling) methods require a significantly greater investment of time and energy early in the life of the project, but they significantly reduce the extent and cost of poor performance and time/cost overruns. Note that this is no guarantee of a trouble-free project, merely a decline in the risk of failure.

-**Monitoring**, the critical project measures as the project proceeds through its life cycle, is required so projects can be realigned with the changing scope, or terminated, if necessary, and new projects initiated. *Monitoring* is collecting, recording, and reporting information concerning any and all aspects of project performance that the Project Manager, the project owner, or others in the organization wish to know. It is important that monitoring, as an activity, should be kept distinct from controlling (which uses the data supplied by monitoring to bring actual performance into approximate congruence with planned performance), as well as from evaluation (through which judgments are made about the quality and effectiveness of project performance).

-**Controlling** is the last element in the implementation cycle of planning–monitoring–controlling. Information is collected about system performance, compared with the desired (or planned) level, and action taken if actual and desired performance differ enough that the controller (manager) wishes to decrease the difference. Note that reporting performance, comparing the differences between desired and actual performance levels, and accounting for why such differences exist are all parts of the control process. In essence, control is the *act* of reducing the difference between plan and reality. It is useful to perceive the control process as a *closed-loop* system, with revised plans and schedules (if warranted) following corrective actions.

The planning–monitoring–controlling cycle is continuously in process until the project is completed. It is also useful to construct this process as an internal part of the organizational structure of the project, not something external to and imposed on it or, worse, in conflict with it. Finally, the planning–monitoring–controlling cycle should be the normal way of life in the parent organization. What is good for the project is equally good for the parent firm. In any case, unless the PM has a smoothly operating monitoring/control system, it will be difficult to manage the project effectively.

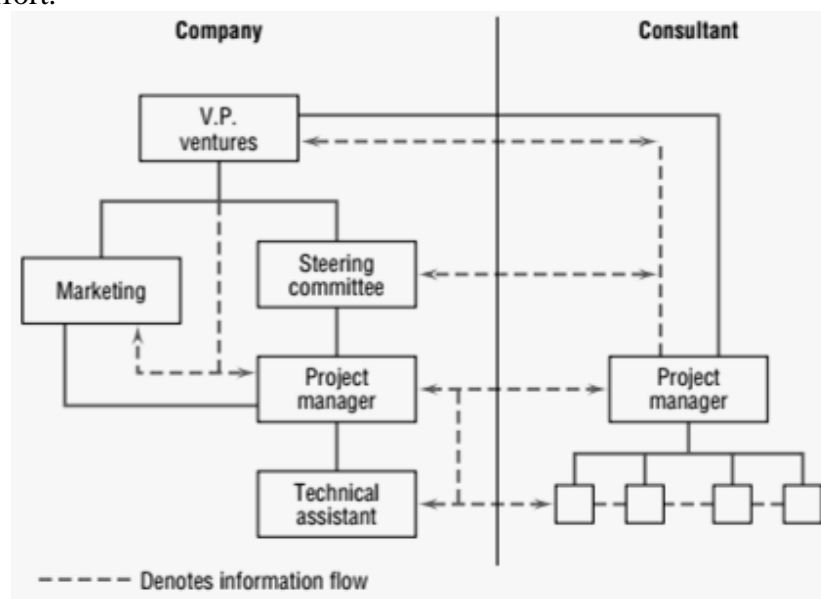
**5.1.2 Information needs and reporting-** The project should be appropriately tied into the project reporting system. The monitoring system ought to be constructed so that it addresses

every level of management, but reports need not be of the same depth or at the same frequency for each level.

-Lower-level personnel have a need for detailed information about individual tasks and the factors affecting such tasks. Report frequency is usually high.

-For the senior management levels, overview reports describe progress in more aggregated terms with less individual task detail unless senior management has a special interest in a specific activity or task. Reports are issued less often.

In both cases, the structure of the reports should reflect the WBS, with each managerial level receiving reports that allow the exercise of control at the relevant level. At times, it may be necessary to move information between organizations, as illustrated in Figure 5.2, as well as between managerial levels. The proliferation of electronic mechanisms along with a wide array of software has made the process of collecting and disseminating information much faster and less arduous than previously. In addition to its use for conducting the routines of project management, the Internet is a rich source of information, including databases on almost anything, patent information, and technical aid for managing projects, to mention only a small fraction of readily available information. Many current project management software packages allow easy connection to the Internet and e-mail to transmit information, charts, networks, and reports practically anywhere. The material can be altered or updated and returned to the sender with minimal effort.



**Fig. 5.2 Reporting and Information flows between organizations working on a common project**

### The Reporting Process

The relationship of project reports to the project WBS is the key to the determination of both report content and frequency.

Reports must contain data relevant to the control of specific tasks that are being carried out according to a specific schedule. The frequency of reporting should be great enough to allow control to be exerted during or before the period in which the task is scheduled for completion. In addition to the criterion that reports should be available in time to be used for project control, the timing of reports should generally correspond to the timing of project milestones. This means that project reports may not be issued periodically—excepting progress reports for senior

management. There seems to be no logical reason, except for tradition, to issue weekly, monthly, quarterly, etc., reports. Reports should be scheduled in the project plan. They should be issued on time. The report schedule, however, need not call for *periodic* reports.

The distribution of project reports depends on who is interested. For senior management, there may be only a few milestones, even in large projects. For the PM, there may be many critical points in the project schedule at which major decisions must be made, large changes in the resource base must be initiated, or key technical results achieved. Similar points relevant to lower levels relate to finer detail and occur with higher frequency. Individual senior managers have widely varying preferences in the frequency and content of reports they wish to see. The PM is well advised to supply them. But irrespective of the senior manager's wishes, the PM must make sure that relevant information about progress is always included—and reported in a way it cannot be overlooked. It is also counterproductive to delay reporting on a current or immediately potential crisis until the next routine report is due.

The nature of the monitoring reports should be consistent with the logic of the planning, budgeting, and scheduling systems. The primary purpose is, of course, to ensure achievement of the project plan through control. There is little reason to burden operating members of the project team with extensive reports on matters that are not subject to control—at least not by them. The scheduling and resource usage columns of the project WBS will serve as the key to the design of project reports. There are many benefits of detailed, timely reports delivered to the proper people.

Among them are:

- Mutual understanding of the goals of the project
- Awareness of the progress of parallel activities and of the problems associated with coordination among activities Understanding the relationships of individual tasks to one another and to the overall project
- Early warning signals of potential problems and delays in the project
- Minimizing the confusion associated with change by reducing delays in communicating the change
- Higher visibility to top management, including attention directed to the immediate needs of the project
- Keeping the client and other interested outside parties up to date on project status, particularly regarding project costs, milestones, and deliverables

### Report Types

For the purposes of project management, we can consider three distinct types of reports: routine, exception, and special analysis.

The routine reports are those issued on a regular basis; but, as we noted earlier, *regular* does not necessarily refer to the calendar. For senior management, the reports will usually be periodic and at major milestones, but for the PM and lower-level project personnel, critical events may be used to trigger routine reports. At times, it may be useful to issue routine reports on resource usage periodically, occasionally on a weekly or even daily basis.

Exception reports are useful in two cases. First, they are directly oriented to project management decision-making and should be distributed to the team members who will have prime responsibility for decisions or who have a clear “need to know.” Second, they may be issued when a decision is made on an exception basis, and it is desirable to inform other managers as well as to document the decision—in other words, as part of a sensible procedure for protecting oneself. (PMs should be aware that overuse of exception reporting will be perceived by top management as sheep-like, overly cautious behavior.)

Special analysis reports are used to disseminate the results of special studies conducted as part of the project or as a response to special problems that arise during the project. Usually, they cover matters that may be of interest to other PMs or make use of analytic methods that might be helpful on other projects. Studies on the use of substitute materials, evaluation of alternative manufacturing processes, availability of external consultants, capabilities of new software, and descriptions of new governmental regulations are all typical of the kinds of subjects covered in special analysis reports. Distribution of these reports is usually made to anyone who might be interested.

### Meetings

Usually “reports” were written and disseminated by hard copy, e-mail, or by Internet. Far more often, however, all three types of reports are delivered in face-to-face meetings or in telephone conference calls. Indeed, senior managers usually insist on face-to-face meetings for staying informed about project progress, and these meetings may touch on almost any subject relevant to the project (or not). Project review meetings can be either highly structured or deceptively casual, but they are always important. A large majority of project meetings do not concern senior management. They are project team meetings, occasionally including the client, and concern the day-to-day problems met on all projects. A few simple rules can remove most of the pain associated with project meetings.

- Use meetings for making group decisions or getting input for important problems. Avoid “show-and-tell” meetings, sometimes called “status and review meetings.” If the latter type of meeting has been used to keep project team members informed about what others are doing on the project, insist that such information be communicated personally or electronically by the relevant individuals to the relevant individuals. Only when there is a clear need, such as informing senior management of the project’s status and it is difficult for team members to “get together” on their own, are status and review meetings appropriate.
- Have preset starting and stopping times as well as a written agenda. Stick with both, and above all, do not penalize those who show up on time by making them wait for those who are tardy.
- Make sure that you (and others) do your homework prior to the meeting. Be prepared!
- If you chair the meeting, take your own minutes. Reality (and the minutes become reality as soon as the meeting is over) is too important to be left to the most junior person present. Distribute the minutes as soon as possible after the meeting, no later than the next work day.
- Avoid attributing remarks or viewpoints to individuals in the minutes. Attribution makes people quite wary about what they say in meetings and damps creativity as well as controversy. In addition, do not report votes on controversial matters.
- Avoid overly formal rules of procedure.
- If a serious problem or crisis arises, call a meeting for the purpose of dealing with that issue only. The stopping time for such meetings may be “When the problem has been solved.” Some types of meetings should never be held at all. A large, diversified manufacturing firm holds monthly “status and review” meetings in each of its divisions at which the managers of all projects report to a Project Review Committee (PRC). The divisional PRCs are made up of senior managers.

### Common Reporting Problems

There are three common difficulties in the design of project reports.

-First, there is usually too much detail, both in the reports themselves and in the input being solicited from workers. Unnecessary detail (or too frequent reporting) usually results in the reports not being read. In addition, it prevents project team members from finding the



information they need. Furthermore, the demand for large quantities of highly detailed input information often results in careless preparation of the data, thereby casting doubt on the validity of reports based on such data. Finally, the preparation and inclusion of unnecessary detail are costly, at the very least.

-A second major problem is the poor interface between the project information system and the parent firm's information system. The parent organization's information system must serve as the definitional prototype for the project's information system. Obviously, different types of reports must be constructed for managing the project, but they can be built by using standard data, for the most part. The PM can feel free to add new kinds of data to the information base but cannot insist that costs, resource usage, and the like be reported in the project differently from how they are reported in the parent organization. The project-oriented firm or the organization that simultaneously conducts a large number of projects can justify a customized project database and report system specifically tailored to its special needs. In such cases, the interface between the project information system and the organization's overall information system must be carefully designed to ensure that data are not lost or distorted when moving from one system to the other. It is also important to make sure that when cost/scope data are reported, the data represent appropriate time periods.

-The third problem concerns a poor correspondence between the planning and the monitoring systems. If the monitoring system is not tracking information directly related to the project's plans, control is meaningless. This often happens when the firm's existing information system is used for monitoring without modifications specifically designed for project management. For example, an existing cost tracking system oriented to shop operations would be inappropriate for a project with major activities in the area of research and development. But as we just noted, the PM's problem is to fit standard information into a reporting and tracking system that is appropriate for the project.

The real message carried by project reports is in the comparison of actual activity to plan and of actual output to desired output. Variances are reported by the monitoring system, and responsibility for action rests with the project owner. Because the project plan is described in terms of scope, time, and cost, variances are reported for those same variables. Project variance reports usually follow the same format used by the accounting department, but at times, they may be presented differently.

### **5.1.3 Engaging with all stakeholders of the projects:**

Monitor Stakeholder Engagement is the process of monitoring project stakeholder relationships and tailoring strategies for engaging stakeholders through modification of engagement strategies and plans. The key benefit of this process is that it maintains or increases the efficiency and effectiveness of stakeholder engagement activities as the project evolves and its environment changes. This process is performed throughout the project. The inputs, tools and techniques, and outputs of the process are depicted in Figure 5.3.

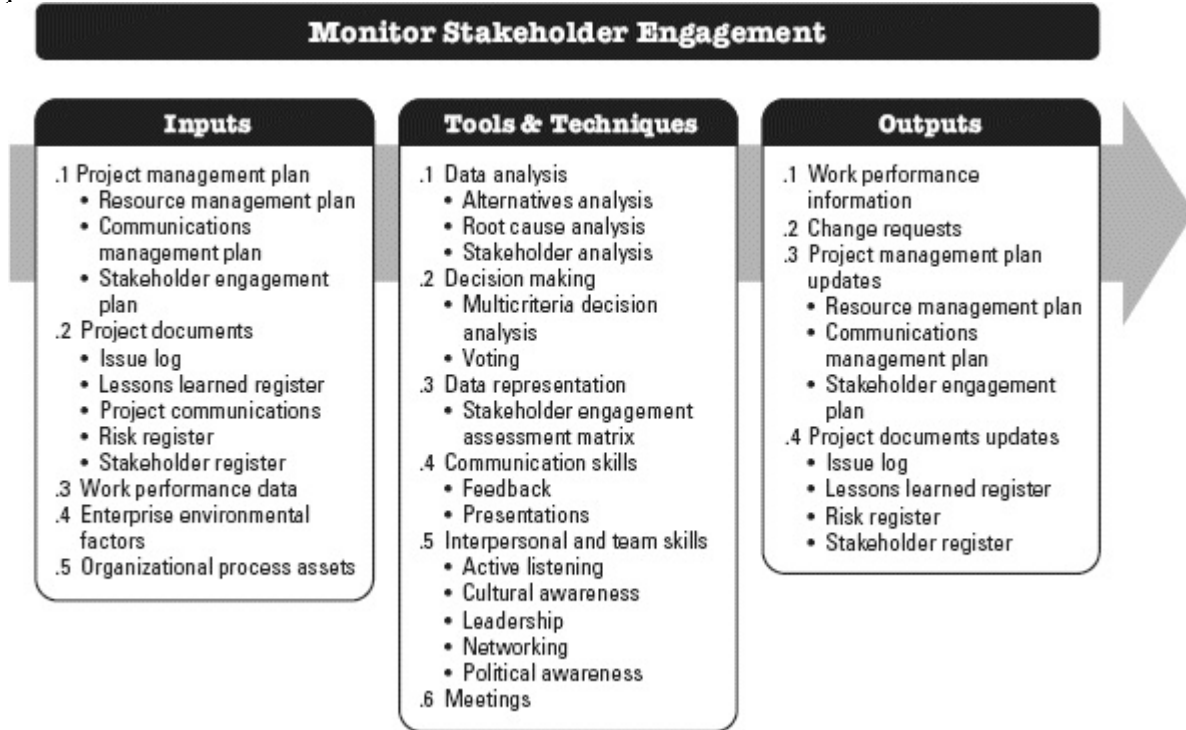
#### **MONITOR STAKEHOLDER ENGAGEMENT: INPUTS**

1 PROJECT MANAGEMENT PLAN- Project management plan components include but are not limited to:

-Resource management plan-The resource management plan identifies the methods for team member management.

-Communications management plan- The communications management plan describes the plans and strategies for communication to the project's stakeholders.

-Stakeholder engagement plan- Defines the plan for managing stakeholder needs and expectations.



**Fig. 5.3 Monitor Stakeholder Engagement: Input, Tools & Techniques and output**

**2 PROJECT DOCUMENTS-** Project documents that can be considered as inputs for this process include but are not limited to:

- Issue log-The issue log documents all the known issues related to the project and stakeholders.
- Lessons learned register-Lessons learned earlier in the project can be applied in later phases of the project to improve the efficiency and effectiveness of engaging stakeholders.
- Project communications-These include the project communications that have been distributed to stakeholders as defined in the communications management plan and the stakeholder engagement plan.
- Risk register-The risk register contains the identified risks for the project, including those related to stakeholder engagement and interactions, their categorization, and list of potential responses.
- Stakeholder register-The stakeholder register contains stakeholder information that includes but is not limited to stakeholder identification, assessment, and classification.

### **3 WORK PERFORMANCE DATA**

Work performance data contains data on project status such as which stakeholders are supportive of the project, and their level and type of engagement.

**4 ENTERPRISE ENVIRONMENTAL FACTORS-** The enterprise environmental factors that can influence the Monitor Stakeholder Engagement process include but are not limited to:

Organizational culture, political climate, governance framework; Personnel administration policies; Stakeholder risk thresholds; Established communication channels; Global, regional, or local trends, practices, or habits; and Geographic distribution of facilities and resources.

**5 ORGANIZATIONAL PROCESS ASSETS-** The organizational process assets that can influence the Monitor Stakeholder Engagement process include but are not limited to:

Corporate policies and procedures for social media, ethics, and security; Corporate policies and procedures for issue, risk, change, and data management; Organizational communication requirement; Standardized guidelines for development, exchange, storage, and retrieval of information; and Historical information from previous projects.

### **MONITOR STAKEHOLDER ENGAGEMENT: TOOLS AND TECHNIQUES**

**1 DATA ANALYSIS-** Data analysis techniques that can be used for this process include but are not limited to:

- Alternatives analysis-Alternatives analysis can be used to evaluate options to respond to variances in the desired results of stakeholder engagement.
- Root cause analysis-A root cause analysis can be used to determine the basic underlying reason that stakeholder engagement is not having the planned effect.
- Stakeholder analysis-The stakeholder analysis helps to determine the position of stakeholder groups and individuals at any particular time in the project.

**2 DECISION MAKING-** Decision-making techniques that can be used for this process include but are not limited to:

- Multicriteria decision analysis-Criteria for successful stakeholder engagement are prioritized and weighted to identify the most appropriate choice.
- Voting-Voting can be used to select the best response for a variance in stakeholder engagement.

**3 DATA REPRESENTATION-** A data representation technique used in this process includes but is not limited to a stakeholder engagement assessment matrix. The stakeholder engagement assessment matrix monitors stakeholder engagement through tracking changes in level of engagement for each stakeholder.

**4 COMMUNICATION SKILLS-** Communication techniques that can be used for this process include but are not limited to:

- Feedback-Feedback is used to ensure that the information to stakeholders is received and understood.
- Presentations-Presentations provide clear information to stakeholders.

**5 INTERPERSONAL AND TEAM SKILLS-** Interpersonal skills to that can be used for this process include but are not limited to:

- Active listening-Active listening is used to reduce misunderstandings and other miscommunication.
- Cultural awareness-Cultural awareness and cultural sensitivity help the project manager to plan communications based on the cultural differences and requirements of stakeholders and team members.
- Leadership-Successful stakeholder engagement requires strong leadership skills to communicate the vision and inspire stakeholders to support the work and outcomes of the project.
- Networking-Networking ensures access to information about levels of engagement of stakeholders.
- Political awareness-Political awareness is used to understand the strategies of the organization understand who wields power and influence in this arena, and to develop an ability to communicate with these stakeholders.

**6 MEETINGS-** Types of meetings include status meetings, standup meetings, retrospectives, and any other meetings as agreed upon in the stakeholder engagement plan to monitor and assess stakeholder engagement levels. Meetings are no longer limited by face-to-face or voice-to voice interactions. While face-to-face interactions are ideal, they can be expensive. Teleconferencing and technology bridge the gap and provide numerous ways to connect and conduct a meeting.



**MONITOR STAKEHOLDER ENGAGEMENT: OUTPUTS**

1 **WORK PERFORMANCE INFORMATION**- Work performance information includes information about the status of stakeholder engagement, such as the level of current project support and compared to the desired levels of engagement as defined in the stakeholder engagement assessment matrix, stakeholder cube, or other tool.

2 **CHANGE REQUESTS**- A change request may include corrective and preventive actions to improve the current level of stakeholder engagement. Change requests are processed for review and disposition through the Perform Integrated Change Control process.

3 **PROJECT MANAGEMENT PLAN UPDATES**- Any change to the project management plan goes through the organization's change control process via a change request. Components of the project management plan that may require a change request include but are not limited to:

- Resource management plan-Team responsibilities for stakeholder engagement activities may need to be updated.

- Communications management plan-The project's communication strategies may need to be updated.

- Stakeholder engagement plan-Information about the project's stakeholder community may need to be updated.

4 **PROJECT DOCUMENTS UPDATES**- Project documents that may be updated as a result of carrying out this process include but are not limited to:

- Issue log-Information in the issue log indicates stakeholder attitudes and may need to be updated.

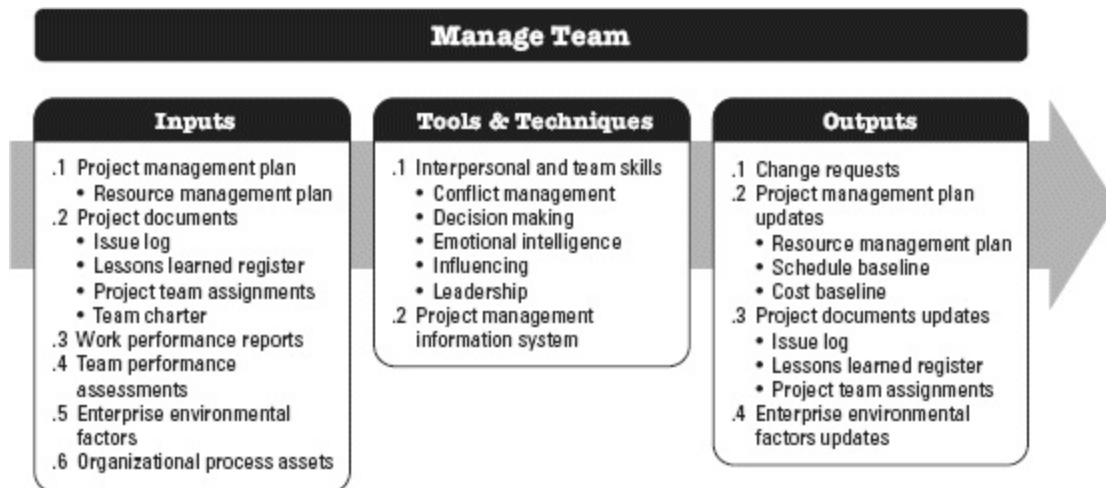
- Lessons learned register-The lessons learned register is updated with information on challenges and how they could have been avoided. It is also updated with approaches that worked well for engaging stakeholders optimally, and those that did not work well.

- Risk register-The risk register may need to be updated with responses to stakeholder risks.

- Stakeholder register-The stakeholder register is updated with information as a result of monitoring stakeholder engagement.

**5.1.4 Team management, communication and project meetings****Team management**

Manage Team is the process of tracking team member performance, providing feedback, resolving issues, and managing team changes to optimize project performance. The key benefit of this process is that it influences team behavior, manages conflict, and resolves issues. This process is performed throughout the project. The inputs, tools and techniques, and outputs of the process are depicted in Figure 5.4. Managing the project team requires a variety of management and leadership skills for fostering teamwork and integrating the efforts of team members to create high-performance teams. Team management involves a combination of skills with special emphasis on communication, conflict management, negotiation, and leadership. Project managers should provide challenging assignments to team members and provide recognition for high performance. The project manager needs to be sensitive to both the willingness and the ability of team members to perform their work and adjust their management and leadership styles accordingly. Team members with low-skill abilities will require more intensive oversight than those who have demonstrated ability and experience.



**Fig. 5.4 Manage Team: Inputs, Tools & Techniques and Outputs**

## MANAGE TEAM: INPUTS

### 1 PROJECT MANAGEMENT PLAN

The project management plan is the document that describes how the project will be executed, monitored and controlled, and closed. It integrates and consolidates all of the subsidiary management plans and baselines, and other information necessary to manage the project. The needs of the project determine which components of the project management plan are needed. Project management plan components include but are not limited to:

#### **Subsidiary management plans:**

- Scope management plan*- Establishes how the scope will be defined, developed, monitored, controlled, and validated.
- Requirements management plan*-Establishes how the requirements will be analyzed, documented, and managed.
- Schedule management plan*-Establishes the criteria and the activities for developing, monitoring, and controlling the schedule.
- Cost management plan*- Establishes how the costs will be planned, structured, and controlled.
- Quality management plan*- Establishes how an organization's quality policies, methodologies, and standards will be implemented in the project.
- Resource management plan*- Provides guidance on how project resources should be categorized, allocated, managed, and released.
- Communications management plan*- Establishes how, when, and by whom information about the project will be administered and disseminated.
- Risk management plan*-Establishes how the risk management activities will be structured and performed.
- Procurement management plan*- Establishes how the project team will acquire goods and services from outside of the performing organization.
- Stakeholder engagement plan*- Establishes how stakeholders will be engaged in project decisions and execution, according to their needs, interests, and impact.

#### **Baselines:**

- Scope baseline*-The approved version of a scope statement, work breakdown structure (WBS), and its associated WBS dictionary, which is used as a basis for comparison.

*-Schedule baseline-* The approved version of the schedule model that is used as a basis for comparison to the actual results.

*-Cost baseline-*The approved version of the time phased project budget that is used as a basis for comparison to the actual results.

Additional components-Most components of the project management plan are produced as outputs from other processes, though some are produced during this process. Those components developed as part of this process will be dependent on the project; however, they often include but are not limited to:

*-Change management plan-*Describes how the change requests throughout the project will be formally authorized and incorporated.

*-Configuration management plan-*Describes how the information about the items of the project (and which items) will be recorded and updated so that the product, service, or result of the project remains consistent and/or operative.

*-Performance measurement baseline-*An integrated scope-schedule-cost plan for the project work against which project execution is compared to measure and manage performance.

*-Project life cycle-*Describes the series of phases that a project passes through from its initiation to its closure.

*-Development approach-*Describes the product, service, or result development approach, such as predictive, iterative, agile, or a hybrid model.

*-Management reviews-*Identifies the points in the project when the project manager and relevant stakeholders will review the project progress to determine if performance is as expected, or if preventive or corrective actions are necessary.

While the project management plan is one of the primary documents used to manage the project, other project documents are also used. These other documents are not part of the project management plan; however, they are necessary to manage the project effectively. [Table 5.1](#) is a representative list of the project management plan components and project documents.

Project Management Plan	Project Documents	
1. Scope management plan	1. Activity attributes	19. Quality control measurements
2. Requirements management plan	2. Activity list	20. Quality metrics
3. Schedule management plan	3. Assumption log	21. Quality report
4. Cost management plan	4. Basis of estimates	22. Requirements documentation
5. Quality management plan	5. Change log	23. Requirements traceability matrix
6. Resource management plan	6. Cost estimates	24. Resource breakdown structure
7. Communications management plan	7. Cost forecasts	25. Resource calendars
8. Risk management plan	8. Duration estimates	26. Resource requirements
9. Procurement management plan	9. Issue log	27. Risk register
10. Stakeholder engagement plan	10. Lessons learned register	28. Risk report
11. Change management plan	11. Milestone list	29. Schedule data
12. Configuration management plan	12. Physical resource assignments 30. Schedule forecasts	
13. Scope baseline	13. Project calendars	31. Stakeholder register
14. Schedule baseline	14. Project communications 32. Team charter	
15. Cost baseline	15. Project schedule 33. Test and evaluation documents	
16. Performance measurement	16. Project	schedule network

baseline	diagram
17. Project life cycle description	17. Project scope statement
18. Development approach	18. Project team assignments

**RESOURCE MANAGEMENT PLAN** - The resource management plan is the component of the project management plan that provides guidance on how project resources should be categorized, allocated, managed, and released. It may be divided between the team management plan and physical resource management plan according to the specifics of the project. The resource management plan may include but is not limited to:

@ Identification of resources- Methods for identifying and quantifying team and physical resources needed.

@ Acquiring resources-Guidance on how to acquire team and physical resources for the project.

**Roles and responsibilities:**

1. *Role*. The function assumed by, or assigned to, a person in the project. Examples of project roles are civil engineer, business analyst, and testing coordinator.

2. *Authority*-The rights to apply project resources, make decisions, sign approvals, accept deliverables, and influence others to carry out the work of the project. Examples of decisions that need clear authority include the selection of a method for completing an activity, quality acceptance criteria, and how to respond to project variances. Team members operate best when their individual levels of authority match their individual responsibilities.

3. *Responsibility*-The assigned duties and work that a project team member is expected to perform in order to complete the project's activities.

4. *Competence*-The skill and capacity required to complete assigned activities within the project constraints. If project team members do not possess required competencies, performance can be jeopardized. When such mismatches are identified, proactive responses such as training, hiring, schedule changes, or scope changes are initiated.

@ Project organization charts-A project organization chart is a graphic display of project team members and their reporting relationships. It can be formal or informal, highly detailed or broadly framed, based on the needs of the project. For example, the project organization chart for a 3,000-person disaster response team will have greater detail than a project organization chart for an internal, 20-person project.

@ Project team resource management-Guidance on how project team resources should be defined, staffed, managed, and eventually released.

@ Training-Training strategies for team members.

@ Team development-Methods for developing the project team.

@ Resource control-Methods for ensuring adequate physical resources are available as needed and that the acquisition of physical resources is optimized for project needs. Includes information on managing inventory, equipment, and supplies during throughout the project life cycle.

@ Recognition plan-Which recognition and rewards will be given to team members, and when they will be given.

**2 PROJECT DOCUMENTS**- Project documents that can be considered as inputs for this process include but are not limited to:

-Issue log- Issues arise in the course of managing the project team. An issue log can be used to document and monitor who is responsible for resolving specific issues by a target date.

-Lessons learned register- Lessons learned earlier in the project can be applied to later phases in the project to improve the efficiency and effectiveness of managing the team.

-Project team assignments- Project team assignments identify the team member roles and responsibilities.

-Team charter- The team charter provides guidance for how the team will make decisions, conduct meetings, and resolve conflict.

**3 WORK PERFORMANCE REPORTS-** Work performance reports are the physical or electronic representation of work performance information intended to generate decisions, actions, or awareness. Performance reports that can help with project team management include results from schedule control, cost control, quality control, and scope validation. The information from performance reports and related forecasts assists in determining future team resource requirements, recognition and rewards, and updates to the resource management plan.

**4 TEAM PERFORMANCE ASSESSMENTS-** The project management team makes ongoing formal or informal assessments of the project team's performance. By continually assessing the project team's performance, actions can be taken to resolve issues, modify communication, address conflict, and improve team interaction.

**5 ENTERPRISE ENVIRONMENTAL FACTORS-** The enterprise environmental factors that can influence the Manage Team process include but are not limited to human resource management policies.

**6 ORGANIZATIONAL PROCESS ASSETS-** The organizational process assets that can influence the Manage Team process include but are not limited to: Certificates of appreciation, corporate apparel, and other organizational perquisites.

### **MANAGE TEAM: TOOLS AND TECHNIQUES**

**1 INTERPERSONAL AND TEAM SKILLS-** Interpersonal and team skills that can be used for this process include but are not limited to:

# Conflict management-Conflict is inevitable in a project environment. Sources of conflict include scarce resources, scheduling priorities, and personal work styles. Team ground rules, group norms, and solid project management practices, like communication planning and role definition, reduce the amount of conflict. Successful conflict management results in greater productivity and positive working relationships. When managed properly, differences of opinion can lead to increased creativity and better decision making. If the differences become a negative factor, project team members are initially responsible for their resolution. If conflict escalates, the project manager should help facilitate a satisfactory resolution. Conflict should be addressed early and usually in private, using a direct, collaborative approach. If disruptive conflict continues, formal procedures may be used, including disciplinary actions. The success of project managers in managing their project teams often depends on their ability to resolve conflict. Different project managers may use different conflict resolution methods. Factors that influence conflict resolution methods include:

- Importance and intensity of the conflict,
- Time pressure for resolving the conflict,
- Relative power of the people involved in the conflict,
- Importance of maintaining a good relationship, and
- Motivation to resolve conflict on a long-term or short-term basis.

There are five general techniques for resolving conflict. Each technique has its place and use:

*\*Withdraw/avoid*-Retreating from an actual or potential conflict situation; postponing the issue to be better prepared or to be resolved by others.

*\*Smooth/accommodate*-Emphasizing areas of agreement rather than areas of difference; conceding one's position to the needs of others to maintain harmony and relationships.



*\*Compromise/reconcile*-Searching for solutions that bring some degree of satisfaction to all parties in order to temporarily or partially resolve the conflict. This approach occasionally results in a lose-lose situation.

*\*Force/direct*-Pushing one's viewpoint at the expense of others; offering only win-lose solutions, usually enforced through a power position to resolve an emergency. This approach often results to a win-lose situation.

*\*Collaborate/problem solve*- Incorporating multiple viewpoints and insights from differing perspectives; requires a cooperative attitude and open dialogue that typically leads to consensus and commitment. This approach can result in a win-win situation.

**#Decision making**-Decision making, in this context, involves the ability to negotiate and influence the organization and the project management team, rather than the set of tools described in the decision making tool set. Some guidelines for decision making include:

- Focus on goals to be served,
- Follow a decision-making process,
- Study the environmental factors,
- Analyze available information,
- Stimulate team creativity, and
- Account for risk.

**#Emotional intelligence**-Emotional intelligence is the ability to identify, assess, and manage the personal emotions of oneself and other people, as well as the collective emotions of groups of people. The team can use emotional intelligence to reduce tension and increase cooperation by identifying, assessing, and controlling the sentiments of project team members, anticipating their actions, acknowledging their concerns, and following up on their issues.

**# Influencing**-Because project managers often have little or no direct authority over team members in a matrix environment, their ability to influence stakeholders on a timely basis is critical to project success. Key influencing skills include:

- Ability to be persuasive;
- Clearly articulating points and positions;
- High levels of active and effective listening skills;
- Awareness of, and consideration for, the various perspectives in any situation; and
- Gathering relevant information to address issues and reach agreements while maintaining mutual trust.

**# Leadership**-Successful projects require leaders with strong leadership skills. Leadership is the ability to lead a team and inspire them to do their jobs well. It encompasses a wide range of skills, abilities and actions. Leadership is important through all phases of the project life cycle. There are multiple leadership theories defining leadership styles that should be used as needed for each situation or team. It is especially important to communicate the vision and inspire the project team to achieve high performance.

## **2 PROJECT MANAGEMENT INFORMATION SYSTEM (PMIS)**

Project management information systems can include resource management or scheduling software that can be used for managing and coordinating team members across project activities.

### **MANAGE TEAM: OUTPUTS**

**1 CHANGE REQUESTS**- When change requests occur as a result of carrying out the Manage Team process or when recommended corrective or preventive actions impact any of the components of the project management plan or project documents, the project manager needs to submit a change request. Change requests are processed for review and disposition through the Perform Integrated Change Control process. For example, staffing changes, whether made by



choice or by uncontrollable events, can disrupt the project team. This disruption can cause the schedule to slip or the budget to be exceeded. Staffing changes include moving people to different assignments, outsourcing some of the work, or replacing team members who leave.

**2 PROJECT MANAGEMENT PLAN UPDATES-** Any change to the project management plan goes through the organization's change control process via a change request. Components of the project management plan that may require a change request for the project management plan include but are not limited to:

- Resource management plan- The resource management plan is updated to reflect actual experience in managing the project team.

- Schedule baseline- Changes to the project schedule may be required to reflect the way the team is performing.

- Cost baseline- Changes to the project cost baseline may be required to reflect the way the team is performing.

**3 PROJECT DOCUMENTS UPDATES-** Project documents that may be updated as a result of carrying out this process include but are not limited to:

- Issue log- New issues raised as a result of this process are recorded in the issue log.

- Lessons learned register- The lessons learned register is updated with information on challenges encountered and how they could have been avoided as well as approaches that worked well for the managing the team.

- Project team assignments- If changes to the team are required, those changes are recorded in the project team assignments documentation.

**4 ENTERPRISE ENVIRONMENTAL FACTORS UPDATES-** Enterprise environmental factors that are updated as a result of the Manage Team process include but are not limited to: Input to organizational performance appraisals, and Personnel skill.

## **MANAGE COMMUNICATIONS**

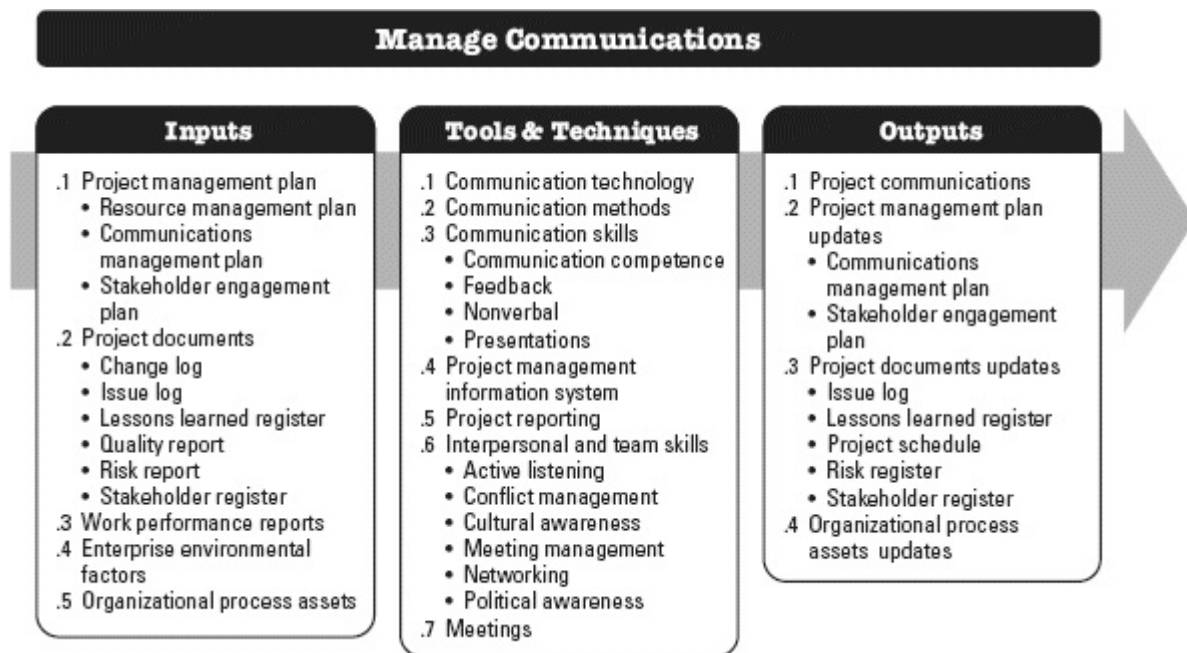
Manage Communications is the process of ensuring timely and appropriate collection, creation, distribution, storage, retrieval, management, monitoring, and the ultimate disposition of project information. The key benefit of this process is that it enables an efficient and effective information flow between the project team and the stakeholders. This process is performed throughout the project. The Manage Communications process identifies all aspects of effective communication, including choice of appropriate technologies, methods, and techniques. In addition, it should allow for flexibility in the communications activities, allowing adjustments in the methods and techniques to accommodate the changing needs of stakeholders and the project. The inputs, tools, techniques, and outputs of this process are depicted in Figure 5.5

**1 PROJECT MANAGEMENT PLAN COMPONENTS-** The project management plan components that may be inputs for this process include but are not limited to: Resource management plan, Communications management plan, and Stakeholder engagement plan.

**2 PROJECT DOCUMENTS -** The project documents that may be inputs for this process include but are not limited to: Change log, Issue log, Lessons learned register, Quality report, Risk report, and Stakeholder register.

**3 PROJECT MANAGEMENT PLAN UPDATES-** The project management plan components that may be updated as a result of this process include but are not limited to: Communications management plan and Stakeholder engagement plan.

**4 PROJECT DOCUMENTS UPDATES -** Project documents that may be updated as a result of this process include but are not limited to: Issue log, Lessons learned register, Project schedule, Risk register, and Stakeholder register. ( All Points are already explained)



**Fig. 5.5 Manage Communication: Inputs, Tools & Techniques and Outputs**

## PROJECT MEETINGS

A meeting can be a vehicle for fostering team building and reinforcing team members' expectations, roles, and commitment to the project objective. This section covers various types of meetings that may take place during a project and provides suggestions for ensuring that meetings are effective.

### TYPES OF PROJECT MEETINGS

The most common types of project meetings are

- Project kickoff meeting
- Status review meetings
- Problem-solving meetings
- Design review meetings
- Postproject evaluation meeting

**Project kickoff meeting:** - The project manager should schedule a project kickoff meeting, also referred to as a project orientation meeting, with the project team. It should be held as early as possible during the forming stage of team development. This is a very important meeting to inform team members, reduce anxiety, manage expectations, and inspire the team. It sets the tone for the entire project. The following are some topics that might be discussed under each of the agenda items:

1. Welcome and introductions. The project manager should provide a brief, warm, and enthusiastic welcome. An important first step in team development is to have the participants, including the project manager, introduce themselves and provide some information about their experience and expertise. This not only gets them involved in the meeting but also informs all the participants about other team members. This should not be done by quickly going around the room and asking each person to merely state their name.

Such an approach discounts the person's value and potential contribution to the project. Sufficient time should be allocated for this agenda item because it is a building block for further team development and team building. However, to ensure that some participants do not use an inordinate amount of time, when the project manager sends out the agenda in advance of the meeting, he or she should indicate that each person will have a specified time limit to tell about his or her experience and expertise.

2. Project overview. The project manager should discuss the elements of the project charter, project proposal, or contract and other background documents or information. These documents should be distributed well in advance of the meeting to give participants sufficient time to review them and come prepared with any comments or questions. This agenda item should be allocated plenty of time so that all questions are addressed. The project manager will need to employ good facilitation skills to keep the discussions on track. The project manager may want to invite the sponsor or customer to this part of the meeting to speak about the importance of the project.

3. Roles and responsibilities. The role and responsibilities of each participant should be discussed so that everyone knows each other's role. Clarification needs to be provided about any perceived or identified overlaps or gaps in responsibilities. If applicable, an initial project organization chart should be provided showing the project reporting relationships, as well as project job descriptions, if appropriate.

4. Processes and procedures. This topic should include a discussion of such items as documentation requirements, approval requirements and processes, communication protocols, and so forth. If the project organization has a change control system, it should be reviewed with an emphasis on avoiding scope creep. If there is a communication plan for the project, it should be distributed to all participants. A communication plan usually includes a list of documents that will be generated during the project, who the authors of each document are, to whom each document should be distributed, the frequency of the document distribution, and who may need to approve or take other action on the document. This agenda item could also include a discussion of problem-solving and conflict-resolution processes. Any documents related to the project processes and procedures should be made available to all project participants, usually through a shared electronic file. Also during this agenda item, to foster team building, the project manager can organize the participants into small groups to work on a process-oriented activity, such as creating ground rules or a code of conduct for behavior at future project team meetings, and then have each group share their list.

5. Expectations. The project manager should discuss the stages of team development to help manage expectations of what the team will go through (especially regarding the storming stage) as the members grow into a high performing team. This is also the time on the agenda for the project manager to demonstrate his or her leadership and inspire the participants to work as a team; respect others; value each person's contribution; have high expectations of themselves and others; communicate openly, honestly, and in a timely fashion; maintain ethical behavior; and so forth.

6. Closing comments. The project manager should again ask if there are any comments or questions and make sure that everyone leaves the meeting with clear expectations of the work to be done and everyone's role. The meeting should end on a high note, with the team eager and enthusiastic to contribute to the success of the project and looking forward to an enjoyable experience during which they can develop and expand their skills and abilities. Another team-building activity that can be valuable is to have a team meal (lunch or dinner) at the end of the meeting so that team members can socialize and get to know each other better. The project kickoff meeting can take several hours or several days, depending on the size and

complexity of the project and the number of participants. It is important to allow enough time and not hurry through it. It is time well spent. If the project has a virtual team with members geographically dispersed, then electronic communication tools should be used to make sure everyone participates.

For larger projects—for example, those that may span several years—the project manager may need to periodically have similar orientation meetings, or a modified version thereof, as new people are added to the project team. In some cases, the manager may choose to have one-on-one individual orientation meetings with people. Also as new people join the project team, the project manager should send out an announcement about them, as well as formally introduce them at the next project meeting.

**Status review meetings:** - A project status review meeting is usually led or called by the project manager; it generally involves all or some of the project team and may also include the customer and/or the project team's upper management. The primary purposes of such a meeting are to inform, to identify problems, and to identify action items. Project status meetings should be held on a regularly scheduled basis so that problems and potential problems can be identified early and surprises that could jeopardize accomplishing the project objective can be prevented. For example, project status review meetings might be held weekly with the project team and less frequently with the customer—perhaps monthly or quarterly, depending on the overall duration of the project and the contractual requirements. Here are some of the subjects that might be discussed under each of the agenda items:

- Accomplishments since the last meeting. Key project milestones that were reached should be identified, and actions on items from previous meetings should be reviewed.
- Cost, schedule, and work scope—status. Performance should be compared to the baseline plan. It is important that status be based on up-to-date information regarding completed activities and actual expenditures.
- Cost, schedule, and work scope—trends. Any positive or negative trends in project performance should be identified. Even if a project is ahead of schedule, the fact that the schedule has been slipping over the past several weeks might indicate that corrective action should be initiated now, before the project falls behind schedule.
- Cost, schedule, and work scope—forecasts. Based on current status, trends, and the project activities yet to be completed, the forecasted project completion date and forecasted cost at completion should be reviewed and compared to the project objective and the baseline plan.
- Cost, schedule, and work scope—variances. Any differences between actual progress and planned progress with respect to cost and schedule for project work packages and activities should be identified. These variances can be positive—for example, being ahead of schedule—or they can be negative—for example, overrunning the budget for the earned value of work that has been accomplished. Negative variances will help pinpoint both current problems and potential problems. Particular attention should be given to those parts of the project that have had negative variances that are continuing to get worse.
- Risk assessment update. Determine if there are any changes to the likelihood of occurrence or the potential impact of any of the previously identified risks. Particular attention should be given to reviewing the trigger points for each risk to determine if any risk response plans are on the verge of having to be implemented. Identify any new risks.
- Stakeholder issues update. Review the stakeholder issue log to make sure that any contentious issues are being addressed in a timely manner. Also identify issues that have been resolved as well as any new issues that have become known.

- **Corrective actions.** In some instances, corrective actions to address problems and potential problems might take place at the status review meeting—for example, receiving customer or management approval to proceed with the purchase of certain materials or authorization of overtime to get the project back on schedule. In other cases, separate problem-solving meetings may be required so that appropriate members of the project team can develop corrective actions—for example, to develop a response to a stakeholder issue to change the planned location of a chemical storage facility because of its proximity to an elementary school.
- **Opportunities for improvement.** Opportunities for improvement should also be identified. For example, a member of the project team might point out that the technical specifications could be met by using an alternative material or piece of equipment that is substantially less expensive than the one the team originally planned to use. Or a team member might suggest that substantial time could be saved by replicating and slightly modifying existing software rather than developing completely new software.
- **Action item assignment.** Specific action items should be identified and assigned to specific team members. For each action item, the person responsible and the estimated completion date should be noted. The completion date should be estimated by the person responsible for the action item. When people verbalize their commitment to a date at a meeting in front of other people, they will usually strive to meet that date. It should be noted that listening to the information provided at a status review meeting is one way, but not the only way, for a project manager to get a true understanding of the project status. He or she needs to validate what was said at the status review meeting through personal communication with individual members of the project team. The project manager should also ask to see any tangible products, or deliverables, such as drawings, prototypes, or reports. This will both validate that the item is really complete (and not just almost or essentially complete) and show that the project manager is genuinely interested in the individual's work and acknowledges its importance to the successful accomplishment of the project objective.

**Problem-solving meetings:-** When a problem or potential problem is identified by an individual project team member, that person should promptly call a problem-solving meeting with other appropriate individuals, not wait for a future status review meeting. Identifying and resolving problems as early as possible is critical to project success. The project manager and the project team need to establish guidelines at the beginning of the project regarding who should initiate problem-solving meetings and when, as well as the level of authorization required to implement corrective actions. Problem-solving meetings should follow a good problem-solving approach, such as the following:

1. Develop a problem statement.
2. Identify potential causes of the problem.
3. Gather data and verify the most likely causes.
4. Identify possible solutions.
5. Evaluate the alternative solutions.
6. Determine the best solution.
7. Revise the project plan.
8. Implement the solution.
9. Determine whether the problem has been solved.

**Design review meetings:** - Projects that involve a design phase, such as development of an information system, design of a website, or design of a floor plan for a hospital renovation, may



require one or more design review meetings to ensure that the sponsor or customer agrees with or approves of the design approach developed by the project team or contractor. Take the example of a company that hires a consultant to design, develop, and implement an information system to track customer orders from order entry through receipt of payment. The company may require that the consultant review the system design with appropriate company representatives before approval of the next phase of the project, which involves detailed development of the system and purchase of hardware and software. At a later stage in the project, the company may want a stakeholder group of certain employees to review and approve the user interface and screen formats developed by the consultant to ensure that they meet the needs and expectations of the people who will be using the system.

In many projects, there are two design review meetings:

1. A preliminary design review meeting occurs when the project team or contractor has completed the initial design, concept drawings, specifications, or flowcharts. The purpose of this preliminary design review meeting is to get the sponsor's or customer's agreement that the design approach meets the requirements and to gain approval from the customer before ordering materials that have a long delivery time so as not to delay the project schedule.
2. A final design review meeting occurs when the project team or contractor has completed the detailed specifications, drawings, screen and report formats, and the like. The purpose of this final design review meeting is to gain approval from the sponsor or customer before starting to build, assemble, and produce the project deliverables.

**Postproject evaluation meeting:-** At the group meeting with the project team, the project manager should lead a discussion of what happened during performance of the project and solicit specific recommendations for improvement. Following are some topics that might be discussed under each of the agenda items:

1. Technical performance. How did the final scope of the work compare to the scope of the work at the start of the project? Were there many changes to the work scope? Were the changes handled properly in terms of documentation, approvals, and communication? What impact did the changes have on project budget and schedule? Was the work scope totally completed? Were the project work and deliverables completed in a quality manner, and did they meet the expectations of the customer?
2. Budget performance. How did the final project actual costs compare with the original project baseline budget and with the final project budget, which included any changes in project scope? If there was a fixed-price contract, was it profitable, or did the project organization lose money? If there was a cost-reimbursement contract, was the project completed within the customer's budget? Were there any particular work packages that overran or under ran their budgets by more than 10 percent? If so, why? What were the causes of any cost overruns? Were the estimated activity costs realistic?
3. Schedule performance. How did the actual project schedule compare with the original schedule? If the project was late, what were the causes? How was performance on the schedule associated with each work package? Were the estimated activity durations realistic?
4. Project planning and control. Was the project planned in sufficient detail? Were the plans updated in a timely manner to incorporate changes? Was actual performance compared with planned performance on a regular basis? Were data on actual performance accurate and collected in a timely manner? Was the planning and control system used on a regular basis by the project team? Was it used for decision making?
5. Risk management. Was the project outcome impacted by the occurrence of any unexpected events? If so, were they identified in the risk plan? Were the high-probability and high-impact



risks adequately identified at the beginning of the project? Were there any risks that should have been, but were not, identified at the beginning of the project? What risks were identified during the project that were not identified at the beginning, and why were they not identified at the beginning? For identified risks that occurred, were the response plans adequate? Were there unexpected events that occurred for which there were no response plans?

6. Customer relationships. Was every effort made to make the customer a participant in the success of the project? Was the customer asked on a regular basis about the level of satisfaction with the performance and progress of the project? Were there regularly scheduled face-to-face meetings with the customer? Was the customer informed of potential problems in a timely manner and asked to participate in the problem-solving process?

7. Stakeholder engagement. Were all key stakeholders identified early? Were the roles and expectations of each stakeholder clear and unambiguous? Were good working relationships developed with each stakeholder? Was there regular communication with all stakeholders? Were stakeholder input, involvement, and discussions welcome? Were stakeholders' concerns addressed early, positively, and in a timely manner?

8. Team relationships. Did the team participate in planning the project? Was there a "team" feeling and a commitment to the success of the project? Were there any conditions that impeded teamwork?

9. Communications. Was the team kept informed of the project status and potential problems in a timely manner? Was the project environment conducive to open, honest, and timely communications? Were project meetings productive? Were written communications within the team and with the customer sufficient, insufficient, or overburdening?

10. Problem identification and resolution. Were mechanisms in place for team members to identify potential problems early? Did appropriate team members participate in problem-solving? Was problem-solving done in a thorough, rational manner?

11. Lessons learned. What worked and what did not? What particular things were done well on the project that helped the project and should be done on other projects? What things were done that hindered the project and should be eliminated or changed on future projects? If there would be an opportunity to start over and do this project again, what should be done differently?

12. Recommendations. Based on the team's discussion and evaluation of the above items, what specific recommendations can be made to help improve performance on future projects? After the evaluation meetings, the project manager should prepare a written report of project performance including lessons learned and recommendations. Project organizations must be proactive and timely in communicating such Postproject reports, excluding any confidential information, to key people in the project organization and ensure that the reports are taken into consideration by project managers and teams on future projects.

### **EFFECTIVE MEETINGS**

Before, during, and after a meeting, the person organizing or leading the meeting can take various steps to ensure that the meeting is effective.

#### **BEFORE THE MEETING**

- Determine whether a meeting is really necessary or whether another mechanism, such as a conference call, is more appropriate.
- Determine the purpose of the meeting. For instance, is it to share information, plan, collect input or ideas, make a decision, persuade or sell, solve a problem, or evaluate status?
- Determine who needs to participate in the meeting, given its purpose. The number of participants should be the minimum number needed to achieve the purpose of the meeting. Project team members are usually busy on their work activities and do not want to participate in

meetings to which they have nothing to contribute or from which they have nothing to gain. Individuals who are invited to attend the meeting should know why they are being asked to participate.

- Distribute an agenda well in advance of the meeting to those invited. The agenda should include:
  - Purpose of the meeting.
  - Topics to be covered. Items should be listed from most important to least important. If time runs out, the most important items will have been covered.
  - Time allocated for each topic and who will cover the topic, make the presentation, or lead the discussion. Accompanying the agenda should be any documents or data the participants need to review prior to the meeting. Sufficient time should be given between distribution of the announcement and the date of the meeting to allow participants to adequately prepare for the meeting. Some participants may need to collect and analyze data or prepare presentation or handout materials.
  - Prepare visual aids or handouts. PowerPoint slides, graphics, charts, tables, diagrams, pictures, and physical models are effective visual aids. Often, these materials focus the discussion and prevent a lot of rambling and misunderstanding. A picture is worth a thousand words!
  - Make meeting room arrangements. The room should be large enough that people are not cramped and uncomfortable. Seats should be arranged so that all participants can see each other; this will foster participation. The appropriate visual aids and accessories (projector, screen, computer, flip charts) should be in the room and be tested before the meeting starts. If any presenters are going to use PowerPoint slides, it saves time to have the files loaded on the computer before the meeting starts. Refreshments should be ordered if the meeting is going to be long. For example, box lunches may be served in order to allow meeting discussions to continue over a working lunch. In some cases, a conference room may be designated as the “project room,” where all project meetings are held or where project team members can meet for problem-solving discussions. Sometimes, such project rooms have project plans, schedules, status charts, and system diagrams posted on the walls for easy reference by all project team members.

#### DURING THE MEETING

- Start the meeting on time. If the meeting leader waits for a few latecomers, people will get in the habit of showing up late, because they know the meeting will not start on time anyway. If the meeting starts on time, people will get in the habit of arriving on time rather than suffer the embarrassment of entering a meeting already in progress.
- Designate a note taker. Someone should be assigned (preferably before the meeting) to take notes. The notes should be concise, and they should cover decisions and action items, assignments, and estimated completion dates. Detailed meeting minutes can be a burden both to take and to read later and therefore should be avoided. Ask all participants to turn off their cell phones, iPods, and other electronic communication devices so that everyone’s full attention is focused on the meeting.
- Review the purpose of the meeting and the agenda. Be concise, and do not give a lengthy discourse.
- Facilitate—do not dominate—the meeting. The project manager should not lead all the discussions, but should get other participants to lead the discussions on their assigned topics. A good facilitator will:
  - Keep the meeting moving and within the scheduled time frame.
  - Encourage participation, especially from individuals who appear hesitant to participate.

- Limit discussion by participants who have a tendency to talk too much, repeat themselves, or stray from the topic at hand.
  - Control interruptions and side conversations.
  - Clarify points that are made.
  - Summarize discussions and make transitions to the next topics on the agenda.
- It is helpful to have the project team participate in developing meeting guidelines at a project team meeting at the beginning of the project, such as at the project kickoff meeting, so that everyone understands and is committed to what behavior is expected during project meetings.
- Summarize the meeting results at the end of the meeting and make sure all participants have a clear understanding of all decisions and action items. The meeting leader should verbalize these items to help avoid any misunderstandings.
  - Do not overrun the scheduled meeting time. Participants may have other commitments or subsequent meetings. If all agenda items are not covered, it is better to schedule another meeting for the people involved with those items. These should be the lower-priority items anyway, because the agenda topics should have been arranged in the order of most to least important.
  - Evaluate the meeting process. Periodically, at the end of a meeting, allocate time for the participants to openly discuss what took place and determine whether any changes should be made to improve the effectiveness of future meetings. The project team members might complete this assessment instrument periodically during the project. After the scores of all team members have been summarized, the team, including the project manager, should discuss how to improve the areas that were rated low.

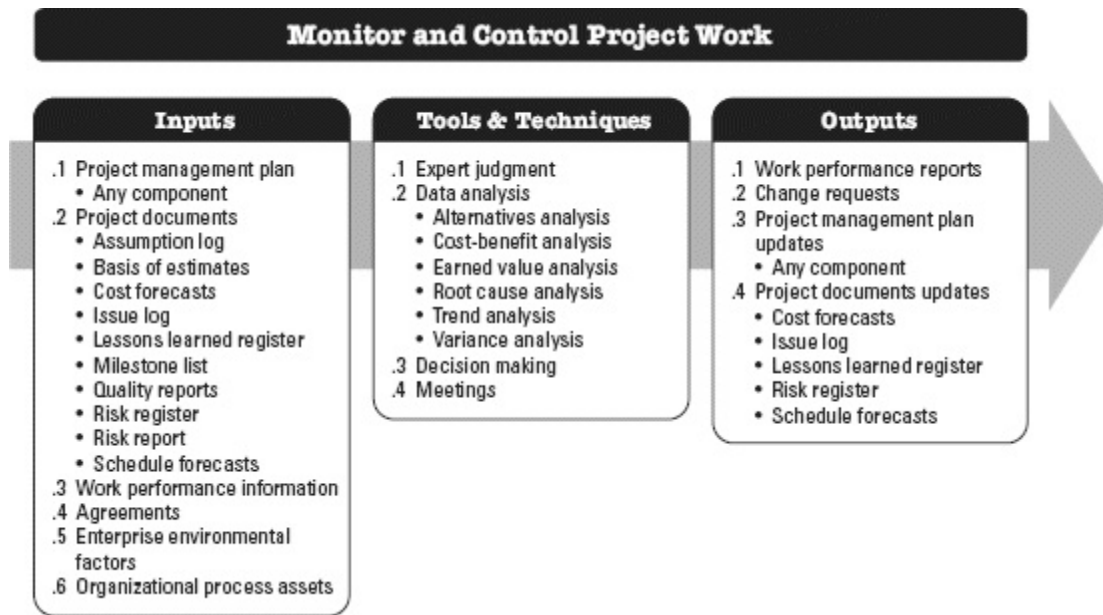
#### AFTER THE MEETING

Publish the meeting results within 24 hours after the meeting. The summary document should be concise and kept to one page if possible. It should confirm decisions that were made and list the action items, including who is responsible, the estimated completion date, and expected deliverables. It may also list who attended and who was absent. The meeting results should be distributed to all individuals who were invited, whether or not they actually attended the meeting. The meeting notes should not include a detailed narrative of the meeting discussions. Effective meetings, like successful projects, require good planning and good performance.

### **5.2 Monitoring and Controlling Projects:**

Monitor and Control Project Work is the process of tracking, reviewing, and reporting the overall progress to meet the performance objectives defined in the project management plan. The key benefits of this process are that it allows stakeholders to understand the current state of the project, to recognize the actions taken to address any performance issues, and to have visibility into the future project status with cost and schedule forecasts. This process is performed throughout the project. The inputs, tools and techniques, and outputs of the process are depicted in Figure 5.6.

Monitoring is an aspect of project management performed throughout the project. Monitoring includes collecting, measuring, and assessing measurements and trends to effect process improvements. Continuous monitoring gives the project management team insight into the health of the project and identifies any areas that may require special attention. Control includes determining corrective or preventive actions or replanning and following up on action plans to determine whether the actions taken resolved the performance issue.



**Fig. 5.6 Monitor and control project works: Inputs, Tools & Techniques and Outputs**

The Monitor and Control Project Work process is concerned with:

- Comparing actual project performance against the project management plan;
- Assessing performance periodically to determine whether any corrective or preventive actions are indicated, and then recommending those actions as necessary;
- Checking the status of individual project risks;
- Maintaining an accurate, timely information base concerning the project's product(s) and their associated documentation through project completion;
- Providing information to support status reporting, progress measurement, and forecasting;
- Providing forecasts to update current cost and current schedule information;
- Monitoring implementation of approved changes as they occur;
- Providing appropriate reporting on project progress and status to program management when the project is part of an overall program; and
- Ensuring that the project stays aligned with the business needs.

#### MONITOR AND CONTROL PROJECT WORK: INPUTS

**1 PROJECT MANAGEMENT PLAN-** Monitoring and controlling project work involves looking at all aspects of the project. Any component of the project management plan may be an input for this process.

**2 PROJECT DOCUMENTS-** Project documents that can be considered as inputs for this process include but are not limited to:

- Assumption log- The assumption log contains information about assumptions and constraints identified as affecting the project.
- Basis of estimates- Basis of estimates indicates how the various estimates were derived and can be used to make a decision on how to respond to variances.
- Cost forecasts- Based on the project's past performance, the cost forecasts are used to determine if the project is within defined tolerance ranges for budget and to identify any necessary change requests.

- Issue log- The issue log is used to document and monitor who is responsible for resolving specific issues by a target date.
- Lessons learned register- The lessons learned register may have information on effective responses for variances, and corrective and preventive actions.
- Milestone list- The milestone list shows the scheduled dates for specific milestones and is used to check if the planned milestones have been met.
- Quality reports- The quality report includes quality management issues; recommendations for process, project, and product improvements; corrective actions recommendations (includes rework, defect/bugs repair, 100% inspection, and more); and the summary of findings from the Control Quality process.
- Risk register- The risk register provides information on threats and opportunities that have occurred during project execution.
- Risk report- The risk report provides information on the overall project risks as well as information on specified individual risks.
- Schedule forecasts- Based on the project's past performance, the schedule forecasts are used to determine if the project is within defined tolerance ranges for schedule and to identify any necessary change requests.

**3 WORK PERFORMANCE INFORMATION-** Work performance data is gathered through work execution and passed to the controlling processes. To become work performance information, the work performance data are compared with the project management plan components, project documents, and other project variables. This comparison indicates how the project is performing. Specific work performance metrics for scope, schedule, budget, and quality are defined at the start of the project as part of the project management plan. Performance data are collected during the project through the controlling processes and compared to the plan and other variables to provide a context for work performance. For example, work performance data on cost may include funds that have been expended. However, to be useful, that data has to be compared to the budget, the work that was performed, the resources used to accomplish the work, and the funding schedule.

This additional information provides the context to determine if the project is on budget or if there is a variance. It also indicates the degree of variance from the plan, and by comparing it to the variance thresholds in the project management plan it can indicate if preventive or corrective action is required. Interpreting work performance data and the additional information as a whole provides a context that provides a sound foundation for project decisions.

**4 AGREEMENTS-** A procurement agreement includes terms and conditions, and may incorporate other items that the buyer specifies regarding what the seller is to perform or provide. If the project is outsourcing part of the work, the project manager needs to oversee the contractor's work to make certain that all the agreements meet the specific needs of the project while adhering to organizational procurement policies.

**5 ENTERPRISE ENVIRONMENTAL FACTORS-** The enterprise environmental factors that can influence the Monitor and Control Project Work process include but are not limited to:

- Project management information systems such as scheduling, cost, resourcing tools, performance indicators, databases, project records, and financials;
- Infrastructure (e.g., existing facilities and equipment, organization's telecommunications channels);
- Stakeholders' expectations and risk thresholds; and

-Government or industry standards (e.g., regulatory agency regulations, product standards, quality standards, and workmanship standards).

**6 ORGANIZATIONAL PROCESS ASSETS-** The organizational process assets that can influence the Monitor and Control Project Work process include but are not limited to:

- Organizational standard policies, processes, and procedures;
- Financial controls procedures (e.g., required expenditure and disbursement reviews, accounting codes, and standard contract provisions);
- Monitoring and reporting methods;
- Issue management procedures defining issue controls, issue identification, and resolution and action item tracking;
- Defect management procedures defining defect controls, defect identification, and resolution and action item tracking; and
- Organizational knowledge base, in particular process measurement and the lessons learned repository.

### **MONITOR AND CONTROL PROJECT WORK: TOOLS AND TECHNIQUES**

**1 EXPERT JUDGMENT-** Expertise should be considered from individuals or groups with specialized knowledge or training in the following topics:

- Earned value analysis,
- Interpretation and contextualization of data,
- Techniques to estimate duration and costs,
- Trend analysis,
- Technical knowledge on the industry and focus area of the project,
- Risk management, and
- Contract management.

**2 DATA ANALYSIS-** Data analysis techniques that can be used include but are not limited to:

- Alternatives analysis- Alternatives analysis is used to select the corrective actions or a combination of corrective and preventive actions to implement when a deviation occurs.
- Cost-benefit analysis- Cost-benefit analysis helps to determine the best corrective action in terms of cost in case of project deviations.
- Earned value analysis- Earned value provides an integrated perspective on scope, schedule, and cost performance.
- Root cause analysis- Root cause analysis focuses on identifying the main reasons of a problem. It can be used to identify the reasons for a deviation and the areas the project manager should focus on in order to achieve the objectives of the project.
- Trend analysis- Trend analysis is used to forecast future performance based on past results. It looks ahead in the project for expected slippages and warns the project manager ahead of time that there may be problems later in the schedule if established trends persist. This information is made available early enough in the project timeline to give the project team time to analyze and correct any anomalies. The results of trend analysis can be used to recommend preventive actions if necessary.
- Variance analysis- Variance analysis reviews the differences (or variance) between planned and actual performance. This can include duration estimates, cost estimates, resources utilization, resources rates, technical performance, and other metrics. Variance analysis may be conducted in each Knowledge Area based on its particular variables. In Monitor and Control Project Work, the variance analysis reviews the variances from an integrated perspective considering cost, time, technical, and resource variances in relation to each other to get an overall view of variance on the project. This allows for the appropriate preventive or corrective actions to be initiated.



3 **DECISION MAKING**- A decision-making techniques that can be used include but are not limited to voting. Voting can include making decisions based on unanimity, majority, or plurality.

4 **MEETINGS**- Meetings may be face-to-face, virtual, formal, or informal. They may include project team members and other project stakeholders when appropriate. Types of meetings include but are not limited to user groups and review meetings.

#### **MONITOR AND CONTROL PROJECT WORK: OUTPUTS**

1 **WORK PERFORMANCE REPORTS** -Work performance information is combined, recorded, and distributed in a physical or electronic form in order to create awareness and generate decisions or actions. Work performance reports are the physical or electronic representation of work performance information intended to generate decisions, actions, or awareness. They are circulated to the project stakeholders through the communication processes as defined in the project communications management plan. Examples of work performance reports include status reports and progress reports. Work performance reports can contain earned value graphs and information, trend lines and forecasts, reserve burndown charts, defect histograms, contract performance information, and risk summaries. They can be presented as dashboards, heat reports, stop light charts, or other representations useful for creating awareness and generating decisions and actions.

2 **CHANGE REQUESTS**- As a result of comparing planned results to actual results, change requests may be issued to expand, adjust, or reduce project scope, product scope, or quality requirements and schedule or cost baselines. Change requests may necessitate the collection and documentation of new requirements. Changes can impact the project management plan, project documents, or product deliverables. Change requests are processed for review and disposition through the Perform Integrated Change Control process. Changes may include but are not limited to:

- Corrective action-An intentional activity that realigns the performance of the project works with the project management plan.

- Preventive action-An intentional activity that ensures the future performance of the project work is aligned with the project management plan.

- Defect repair-An intentional activity that modifies a nonconforming product or product component.

3 **PROJECT MANAGEMENT PLAN UPDATES**- Any change to the project management plan goes through the organization's change control process via a change request. Changes identified during the Monitor and Control Project Work process may affect the overall project management plan.

4 **PROJECT DOCUMENTS UPDATES**- Project documents that may be updated as a result of carrying out this process include but are not limited to:

- Cost forecasts- Changes in cost forecasts resulting from this process are recorded using cost management processes.

- Issue log- New issues raised as a result of this process are recorded in the issue log.

- Lessons learned register-The lessons learned register is updated with effective responses for variances and corrective and preventive actions.

- Risk register-New risks identified during this process are recorded in the risk register and managed using the risk management processes.

- Schedule forecasts- Changes in schedule forecasts resulting from this process are recorded using schedule management processes.

### 5.2.1 Earned Value Management techniques for measuring value of work completed:

**Earned value analysis (EVA)-** Earned value analysis compares the performance measurement baseline to the actual schedule and cost performance. EVM integrates the scope baseline with the cost baseline and schedule baseline to form the performance measurement baseline. EVM develops and monitors three key dimensions for each work package and control account:

1. *Planned value.* Planned value (PV) is the authorized budget assigned to scheduled work. It is the authorized budget planned for the work to be accomplished for an activity or work breakdown structure (WBS) component, not including management reserve. This budget is allocated by phase over the life of the project, but at a given point in time, planned value defines the physical work that should have been accomplished. The total of the PV is sometimes referred to as the performance measurement baseline (PMB). The total planned value for the project is also known as budget at completion (BAC).

2. *Earned value.* Earned value (EV) is a measure of work performed expressed in terms of the budget authorized for that work. It is the budget associated with the authorized work that has been completed. The EV being measured needs to be related to the PMB, and the EV measured cannot be greater than the authorized PV budget for a component. The EV is often used to calculate the percent complete of a project. Progress measurement criteria should be established for each WBS component to measure work in progress. Project managers monitor EV, both incrementally to determine current status and cumulatively to determine the long-term performance trends.

3. *Actual cost.* Actual cost (AC) is the realized cost incurred for the work performed on an activity during a specific time period. It is the total cost incurred in accomplishing the work that the EV measured. The AC needs to correspond in definition to what was budgeted in the PV and measured in the EV (e.g., direct hours only, direct costs only, or all costs including indirect costs). The AC will have no upper limit; whatever is spent to achieve the EV will be measured.

**Variance analysis-** Variance analysis reviews the differences (or variance) between planned and actual performance. This can include duration estimates, cost estimates, resources utilization, resources rates, technical performance, and other metrics. Variance analysis may be conducted in each Knowledge Area based on its particular variables. In Monitor and Control Project Work, the variance analysis reviews the variances from an integrated perspective considering cost, time, technical, and resource variances in relation to each other to get an overall view of variance on the project. This allows for the appropriate preventive or corrective actions to be initiated.

Variance analysis, as used in EVM, is the explanation (cause, impact, and corrective actions) for cost ( $CV = EV - AC$ ), schedule ( $SV = EV - PV$ ), and variance at completion ( $VAC = BAC - EAC$ ) variances. Cost and schedule variances are the most frequently analyzed measurements. For projects not using formal earned value analysis, similar variance analyses can be performed by comparing planned cost against actual cost to identify variances between the cost baseline and actual project performance. Further analysis can be performed to determine the cause and degree of variance relative to the schedule baseline and any corrective or preventive actions needed. Cost performance measurements are used to assess the magnitude of variation to the original cost baseline. An important aspect of project cost control includes determining the cause and degree of variance relative to the cost baseline and deciding whether corrective or preventive action is required. The percentage range of acceptable variances will tend to decrease as more work is accomplished. Examples of variance analysis include but are not limited to:

*-Schedule variance.* Schedule variance (SV) is a measure of schedule performance expressed as the difference between the earned value and the planned value. It is the amount by which the project is ahead or behind the planned delivery date, at a given point in time. It is a measure of schedule performance on a project. It is equal to the earned value (EV) minus the planned value (PV). The EVA schedule variance is a useful metric in that it can indicate when a project is falling behind or is ahead of its baseline schedule. The EVA schedule variance will ultimately equal zero when the project is completed because all of the planned values will have been earned. Schedule variance is best used in conjunction with critical path method (CPM) scheduling and risk management. Equation:  $SV = EV - PV$ .

*-Cost variance.* Cost variance (CV) is the amount of budget deficit or surplus at a given point in time, expressed as the difference between earned value and the actual cost. It is a measure of cost performance on a project. It is equal to the earned value (EV) minus the actual cost (AC). The cost variance at the end of the project will be the difference between the budget at completion (BAC) and the actual amount spent. The CV is particularly critical because it indicates the relationship of physical performance to the costs spent. Negative CV is often difficult for the project to recover. Equation:  $CV = EV - AC$ .

*-Schedule performance index.* The schedule performance index (SPI) is a measure of schedule efficiency expressed as the ratio of earned value to planned value. It measures how efficiently the project team is accomplishing the work. It is sometimes used in conjunction with the cost performance index (CPI) to forecast the final project completion estimates. An SPI value less than 1.0 indicates less work was completed than was planned. An SPI greater than 1.0 indicates that more work was completed than was planned. Since the SPI measures all project work, the performance on the critical path also needs to be analyzed to determine whether the project will finish ahead of or behind its planned finish date. The SPI is equal to the ratio of the EV to the PV. Equation:  $SPI = EV/PV$ .

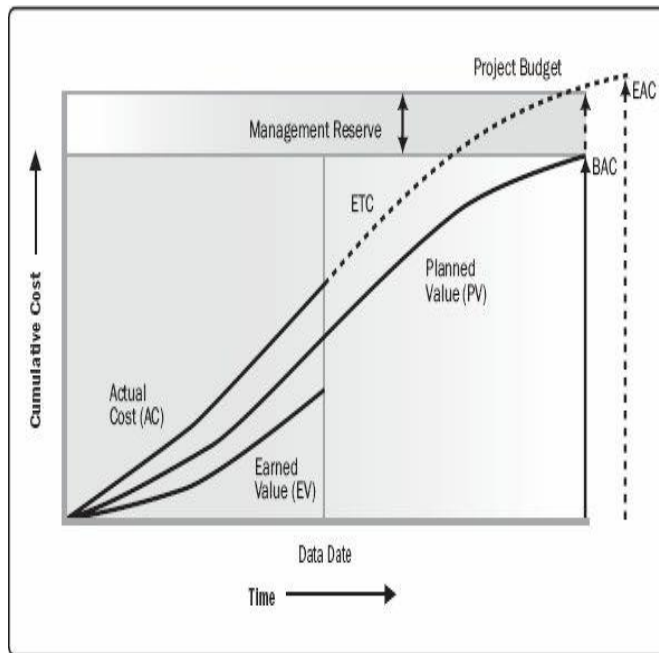
*-Cost performance index.* The cost performance index (CPI) is a measure of the cost efficiency of budgeted resources, expressed as a ratio of earned value to actual cost. It is considered the most critical EVA metric and measures the cost efficiency for the work completed. A CPI value of less than 1.0 indicates a cost overrun for work completed. A CPI value greater than 1.0 indicates a cost underrun of performance to date. The CPI is equal to the ratio of the EV to the AC. Equation:  $CPI = EV/AC$ .

**Trend analysis-**Trend analysis examines project performance over time to determine if performance is improving or deteriorating. Graphical analysis techniques are valuable for understanding performance to date and for comparison to future performance goals in the form of BAC versus estimate at completion (EAC) and completion dates.

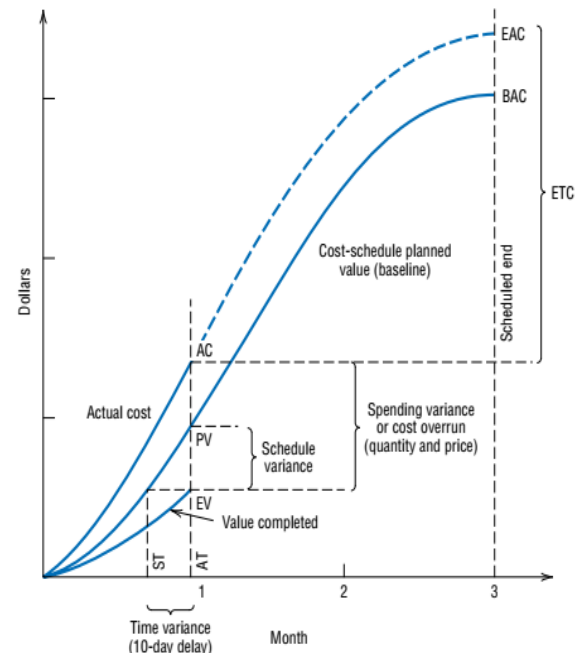
Examples of the trend analysis techniques include but are not limited to:

*-Charts.* In earned value analysis, three parameters of planned value, earned value, and actual cost can be monitored and reported on both a period-by period basis (typically weekly or monthly) and on a cumulative basis. Figure 5.7 uses S-curves to display EV data for a project that is performing over budget and behind the schedule.

EACs are typically based on the actual costs incurred for work completed, plus an estimate to complete (ETC) the remaining work. It is incumbent on the project team to predict what it may encounter to perform the ETC, based on its experience to date. Earned value analysis works well in conjunction with manual forecasts of the required EAC costs. The most common EAC forecasting approach is a manual, bottom-up summation by the project manager and project team.



**Fig. 5.7 Earned Value, Planned Value and Actual Costs**



**Fig. 5.8 Earned Value Chart**

The project manager's bottom-up EAC method builds upon the actual costs and experience incurred for the work completed, and requires a new estimate to complete the remaining project work. Equation:  $EAC = AC + \text{Bottom-up ETC}$ . The project manager's manual EAC is quickly compared with a range of calculated EACs representing various risk scenarios. When calculating EAC values, the cumulative CPI and SPI values are typically used. While EVM data quickly provide many statistical EACs, only three of the more common methods are described as follows:

*-EAC forecast for ETC work performed at the budgeted rate.* This EAC method accepts the actual project performance to date (whether favorable or unfavorable) as represented by the actual costs, and predicts that all future ETC work will be accomplished at the budgeted rate. When

actual performance is unfavorable, the assumption that future performance will improve should be accepted only when supported by project risk analysis. Equation:  $EAC = AC + (BAC - EV)$ .

*-EAC forecast for ETC work performed at the present CPI.* This method assumes that what the project has experienced to date can be expected to continue in the future. The ETC work is assumed to be performed at the same cumulative cost performance index (CPI) as that incurred by the project to date. Equation:  $EAC = BAC / CPI$ .

*EAC forecast for ETC work considering both SPI and CPI factors.* In this forecast, the ETC work will be performed at an efficiency rate that considers both the cost and schedule performance indices. This method is most useful when the project schedule is a factor impacting the ETC effort. Variations of this method weight the CPI and SPI at different values (e.g., 80/20, 50/50, or some other ratio) according to the project manager's judgment. Equation:  $EAC = AC + [(BAC - EV) / (CPI \times SPI)]$ .

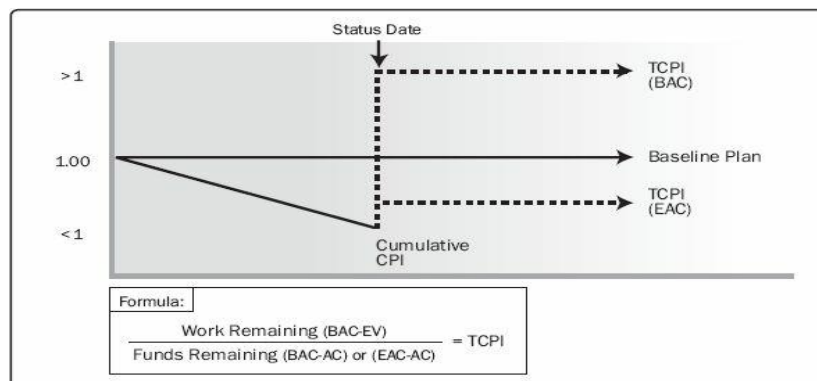
**Reserve analysis-** During cost control, reserve analysis is used to monitor the status of contingency and management reserves for the project to determine if these reserves are still needed or if additional reserves need to be requested. As work on the project progresses, these

reserves may be used as planned to cover the cost of risk responses or other contingencies. Conversely, when opportunities are captured and resulting in cost savings, funds may be added to the contingency amount, or taken from the project as margin/profit. If the identified risks do not occur, the unused contingency reserves may be removed from the project budget to free up resources for other projects or operations. Additional risk analysis during the project may reveal a need to request that additional reserves be added to the project budget.

**TO-COMPLETE PERFORMANCE INDEX- TCPI** The to-complete performance index (TCPI) is a measure of the cost performance that is required to be achieved with the remaining resources in order to meet a specified management goal, expressed as the ratio of the cost to finish the outstanding work to the remaining budget. TCPI is the calculated cost performance index that is achieved on the remaining work to meet a specified management goal, such as the BAC or the EAC. If it becomes obvious that the BAC is no longer viable, the project manager should consider the forecasted EAC. Once approved, the EAC may replace the BAC in the TCPI calculation.

The equation for the TCPI based on the BAC:  $(BAC - EV) / (BAC - AC)$ . The TCPI is conceptually displayed in Figure 5.9. The equation for the TCPI is shown in the lower left as the work remaining (defined as the BAC minus the EV) divided by the funds remaining (which can be either the BAC minus the AC, or the EAC minus the AC).

If the cumulative CPI falls below the baseline (as shown in Figure 5.9), all future work of the project will need to be performed immediately in the range of the TCPI (BAC) (as reflected in the top line of Figure 5.9) to stay within the authorized BAC. Whether this level of performance is achievable is a judgment call based on a number of considerations, including risk, time remaining in the project, and technical performance. This level of performance is displayed as the TCPI (EAC) line. The equation for the TCPI is based on the EAC:  $(BAC - EV) / (EAC - AC)$ . The EVM formulas are provided in Table 5.2.



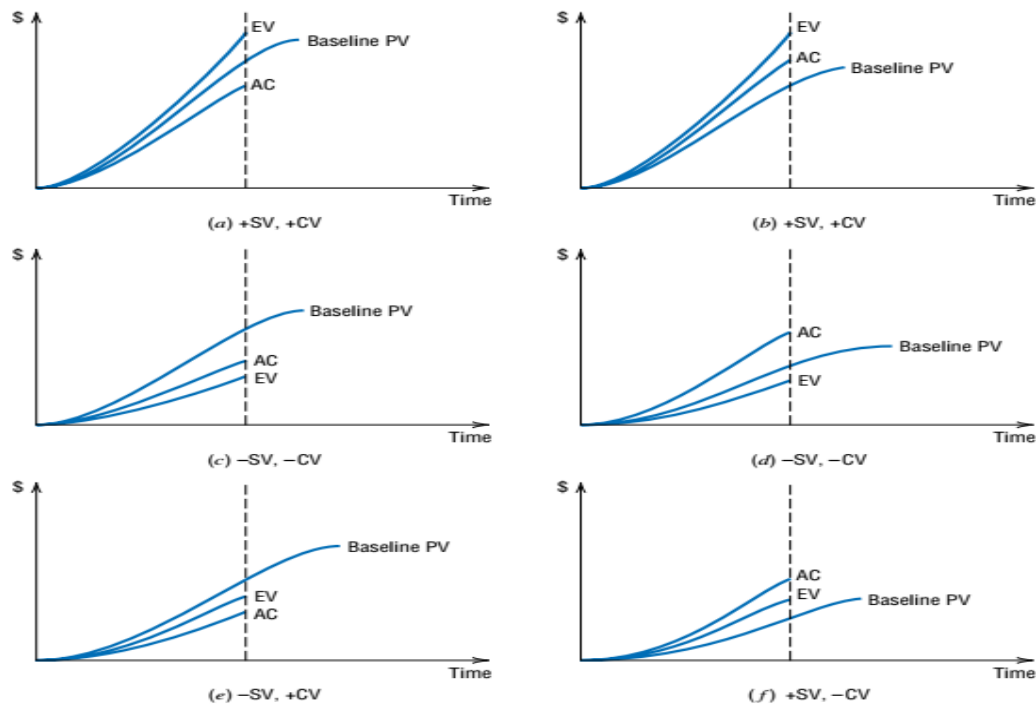
**Fig. 5.9 To-Complete Performance Index (TCPI)**

It is quite possible for one of the indicators to be favorable while the other is unfavorable. We might be ahead of schedule and behind in cost, or vice versa. There are six possibilities in total, all illustrated in Figure 5.10.

**Table 5.2 Earned Value Analysis Calculations summary**

Earned Value Analysis					
Abbreviation	Name	Lexicon Definition	How Used	Equation	Interpretation of Result
<b>PV</b>	Planned Value	The authorized budget assigned to scheduled work.	The value of the work planned to be completed to a point in time, usually the data date, or project completion.		
<b>EV</b>	Earned Value	The measure of work performed expressed in terms of the budget authorized for that work.	The planned value of all the work completed (earned) to a point in time, usually the data date, without reference to actual costs.	$EV = \text{sum of the planned value of completed work}$	
<b>AC</b>	Actual Cost	The realized cost incurred for the work performed on an activity during a specific time period.	The actual cost of all the work completed to a point in time, usually the data date.		
<b>BAC</b>	Budget at Completion	The sum of all budgets established for the work to be performed.	The value of total planned work, the project cost baseline.		
<b>CV</b>	Cost Variance	The amount of budget deficit or surplus at a given point in time, expressed as the difference between the earned value and the actual cost.	The difference between the value of work completed to a point in time, usually the data date, and the actual costs to the same point in time.	$CV = EV - AC$	Positive = Under planned cost Neutral = On planned cost Negative = Over planned cost
<b>SV</b>	Schedule Variance	The amount by which the project is ahead or behind the planned delivery date, at a given point in time, expressed as the difference between the earned value and the planned value.	The difference between the work completed to a point in time, usually the data date, and the work planned to be completed to the same point in time.	$SV = EV - PV$	Positive = Ahead of Schedule Neutral = On schedule Negative = Behind Schedule
<b>VAC</b>	Variance at Completion	A projection of the amount of budget deficit or surplus, expressed as the difference between the budget at completion and the estimate at completion.	The estimated difference in cost at the completion of the project.	$VAC = BAC - EAC$	Positive = Under planned cost Neutral = On planned cost Negative = Over planned cost
<b>CPI</b>	Cost Performance Index	A measure of the cost efficiency of budgeted resources expressed as the ratio of earned value to actual cost.	A CPI of 1.0 means the project is exactly on budget that the work actually done so far is exactly the same as the cost so far. Other values show the percentage of how much costs are over or under the budgeted amount for work accomplished.	$CPI = EV/AC$	Greater than 1.0 = Under planned cost Exactly 1.0 = On planned cost Less than 1.0 = Over planned cost
<b>SPI</b>	Schedule Performance Index	A measure of schedule efficiency expressed as the ratio of earned value to planned value.	An SPI of 1.0 means that the project is exactly on schedule, that the work actually done so far is exactly the same as the work planned to be done so far. Other values show the percentage of how much costs are over or under the budgeted amount for work planned.	$SPI = EV/PV$	Greater than 1.0 = Ahead of schedule Exactly 1.0 = On schedule Less than 1.0 = Behind schedule
<b>EAC</b>	Estimate At Completion	The expected total cost of completing all work expressed as the sum of the actual cost to date and the estimate to complete.	If the CPI is expected to be the same for the remainder of the project, EAC can be calculated using:	$EAC = BAC/CPI$	
			If future work will be accomplished at the planned rate, use:	$EAC = AC + BAC - EV$	
			If the initial plan is no longer valid, use:	$EAC = AC + \text{Bottom-up ETC}$	
			If both the CPI and SPI influence the remaining work, use:	$EAC = AC + [(BAC - EV)/(CPI \times SPI)]$	
<b>ETC</b>	Estimate to Complete	The expected cost to finish all the remaining project work.	Assuming work is proceeding on plan, the cost of completing the remaining authorized work can be calculated using:	$ETC = EAC - AC$	
			Reestimate the remaining work from the bottom up.	$ETC = \text{Reestimate}$	
<b>TCPI</b>	To Complete Performance Index	A measure of the cost performance that must be achieved with the remaining resources in order to meet a specified management goal, expressed as the ratio of the cost to finish the outstanding work to the budget available.	If the initial plan is no longer valid, use: <b>BAC Valid</b>	$TCPI = (BAC - EV)/(BAC - AC)$	Greater than 1.0 = Harder to complete Exactly 1.0 = Same to complete Less than 1.0 = Easier to complete
			The efficiency that must be maintained in order to complete the current EAC. <b>BAC Not Valid</b>	$TCPI = (BAC - EV)/(EAC - AC)$	Greater than 1.0 = Harder to complete Exactly 1.0 = Same to complete Less than 1.0 = Easier to complete





**Fig. 5.10 Six Possible arrangements of AC, EV and PV resulting in four combination of +ve & -ve Schedule Variance (SV) and cost Variance (CV)**

### 5.2.2 Using milestones for measurement; change requests and scope creep, Project audit

Project changes, result from three basic causes: (1) uncertainty about the technology on which the work of the project or its output is based; (2) an increase in the knowledge base or sophistication of the client/user leading to scope creep; and (3) a modification of the rules applying to the process of carrying out the project or to its output. All three of these causes are especially common in software projects, where scope creep is legendary. When either the process or output of a project is changed, there is almost always a concomitant change in the budget and/or schedule.

#### Using milestones for measurement-

Milestone analysis is one of the simpler methods which managers can use throughout the project life cycle to compare the actual costs and progress experienced with the costs and progress planned. The method is less effective and less detailed than others described later in this chapter, but it has the merit of needing a relatively modest amount of management effort to set up and maintain. It also requires less sophisticated cost accounting than other methods and can be used when project schedules are not particularly detailed. Perhaps the best way to demonstrate the benefits of milestone analysis would be to begin by considering what happens when actual costs are compared against cost budgets when there are no milestones or other relevant information about the progress achieved.

#### Importance of Milestone analysis -

##### Cost monitoring without milestones

Figure 5.11 shows the kinds of curves that might result if total project costs are recorded regularly and plotted on a graph against time and the budget. The practice depends on first

plotting a graph of expected costs against time. Such graphs are sometimes known as time-scaled budgets. The time-scaled budget in Figure 5.11 is represented by the dotted curve. This curve was plotted by combining information from the cost estimates and the project plan, so that the estimated costs for all work packages are included in the curve at their scheduled times. The project manager should, therefore, be able to consult the graph at any time during the execution of the project to find the amount of total project costs that should have been reached if all is going to plan.

In the absence of a suitable work breakdown with budgets it would not, of course, be possible to draw a time-scaled budget curve. In that case, the best that could be done would be to draw the budget as a straight line joining two points, starting from zero cost at the graph's origin and reaching the total estimated cost at the planned completion date. That approach can be dismissed as being of no use whatever. The actual cumulative project costs can be plotted at suitable intervals on the same axes as the time-scaled budget. If the costing system is at all reasonable, it will be possible to plot these costs fairly accurately. This has been done in Figure 5.11, where it can be seen that actual costs have been recorded up to the end of week 28.

### **Interpreting the result where there are no milestones**

Graphs that attempt to compare actual costs with the time-scaled budget, even when they are plotted with great care, are of very limited management use as they stand. The missing piece of information in Figure 5.11 is the corresponding progress or achievement. At one extreme, if no money is being spent at all, then it is a fair assumption that no progress is being made either. It is also true and easily understood that a significantly low rate of expenditure usually indicates an inadequate rate of progress and achievement. Unfortunately, some managers then proceed to make the less acceptable assumption that if expenditure is being incurred at the planned rate, then progress and achievement must also be either on plan or 'about right'. This is a very rough and ready guide that can lead to dangerously wrong conclusions. Suppose that the project illustrated in Figure 5.11 has been running for 32 weeks, when the planned expenditure should then be £500 000. There are people who would be well satisfied on being told that the reported expenditure is at or just below £500 000. But those people fail to ask all the vital questions which should be considered by any project manager, namely:

How much have we spent to date?

What should we have spent to date?

What have we achieved so far?

What should we have achieved by this time?

What are the final cost and delivery prospects for the project if our performance continues at the current level?

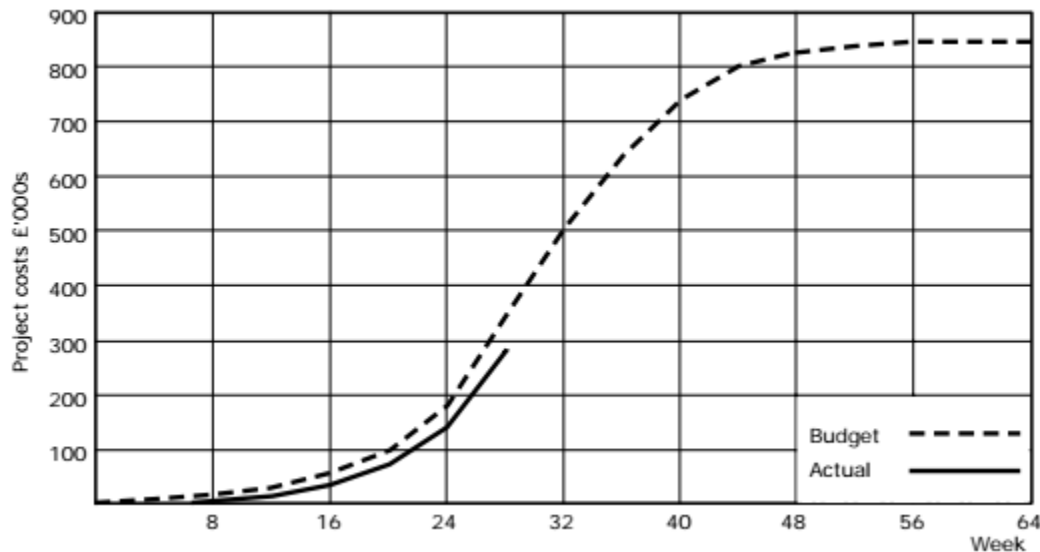
Milestone monitoring can help to answer these questions.

### **Explanation of the milestone method**

**Identifying milestones-**The first requirement in milestone analysis is to understand what is meant by a milestone. A milestone denotes a particular, easily identifiable stage in the progress of a project towards completion. It might be acceptance by the customer of a final design concept or layout drawing, the issue of a package of drawings for work to begin, the day when a building is made watertight so that internal trades can start, the date when electrical power is first switched on to a new installation, or any other such occasion.

All good project management software allows the user to designate appropriate activities as milestones. Each milestone is then achieved when the relevant milestone activity is reported as finished. This becomes a little complicated when a true project milestone depends on completion of more than one parallel activity. Precedence notation, however, is very adaptable and it is easy

to solve this problem by creating milestone events artificially. All that is necessary is to insert milestone activities with zero or unit duration at the appropriate network intersections. This is rather similar to the creation of artificial dummies. Milestone analysis starts, therefore, by choosing and naming the achievements that can most effectively be used as project milestones. Ideally, milestones should coincide with the completion of packages from the work breakdown structure. That approach will be assumed here.



**Fig. 5.11 Comparison of actual costs against a time-scaled budget**

### Plotting the budget/milestone plan

For each milestone, two pieces of data are required. These are:

- the date on which the milestone is scheduled to be achieved;
- the estimated cost or budget for the associated work package (that is, the expected cost of all the work needed to achieve the milestone).

When all milestone data are available the milestone/budget curve can be plotted. This process starts by sketching the time-scaled budget curve. The position of each point is determined by matching the cumulative cost estimates for the project work packages against the planned achievement dates for those work packages. It might be necessary to use all the constituent tasks, rather than complete work packages, to produce sufficient points on the graph. Care must be taken to ensure that no estimated costs are left out, so that the budget curve will reach the cost estimated for the project. So far this is similar to the process used to produce the time-scaled budget curve in Figure 5.11. To complete the budget/milestone graph, symbols must be added to the budget curve to represent all the milestones. Each milestone must be positioned on the budget curve at the date scheduled for its completion.

### Plotting the graph of actual expenditure and milestone achievement

To be able to plot the graph of actual expenditure for comparison against the plan, two further items of information must be collected:

- the date on which each milestone was actually achieved;
- the project costs actually incurred (including committed costs of purchased items) at the end of each cost monitoring period. It must therefore be assumed that a procedure exists for recording the total costs actually incurred and committed for the project at suitable intervals. These intervals might be weekly or monthly, and will depend to some extent on the life cycle time for

the project. The actual costs can be plotted as a graph on the same axes as the time-scaled budget. Points on the graph should be highlighted by symbols that indicate the actual completion date for each milestone. To be able to compare the planned and actual graphs sensibly, it helps enormously if all the milestones can be given simple numbers. If the milestones marked on the budget curve are, for example, numbered 1, 2, 3 and so on, the corresponding points on the actual cost graph can carry the same numbers to make comparison easy.

### **Disadvantages of the milestone method**

The milestone method suffers from a few disadvantages. These include the following:

- The information that can be extracted for management use in controlling the project is often obtained after the damage has been done, and certainly much later than the predictions possible with more detailed earned-value analysis (described below).
- If programme slippages are going to occur very often, the curves may have to be redrawn frequently, unless a computer can be used or some very flexible charting method is devised.
- The method takes only an approximate account of work-in-progress (work packages which have been started, but where the milestones have yet to be achieved).
- The method only shows coarse trends rather than the more detailed measurements obtainable with earned-value analysis.
- It is not easy to use the results of milestone analysis to predict the probable final outcome for the project.

However, the method involves comparatively little effort, is a considerable improvement on simple cost versus budget comparison, and may therefore commend itself to the busy project manager.

**Change Requests-** No project of any significant size can be expected to run from start to finish without at least one change.

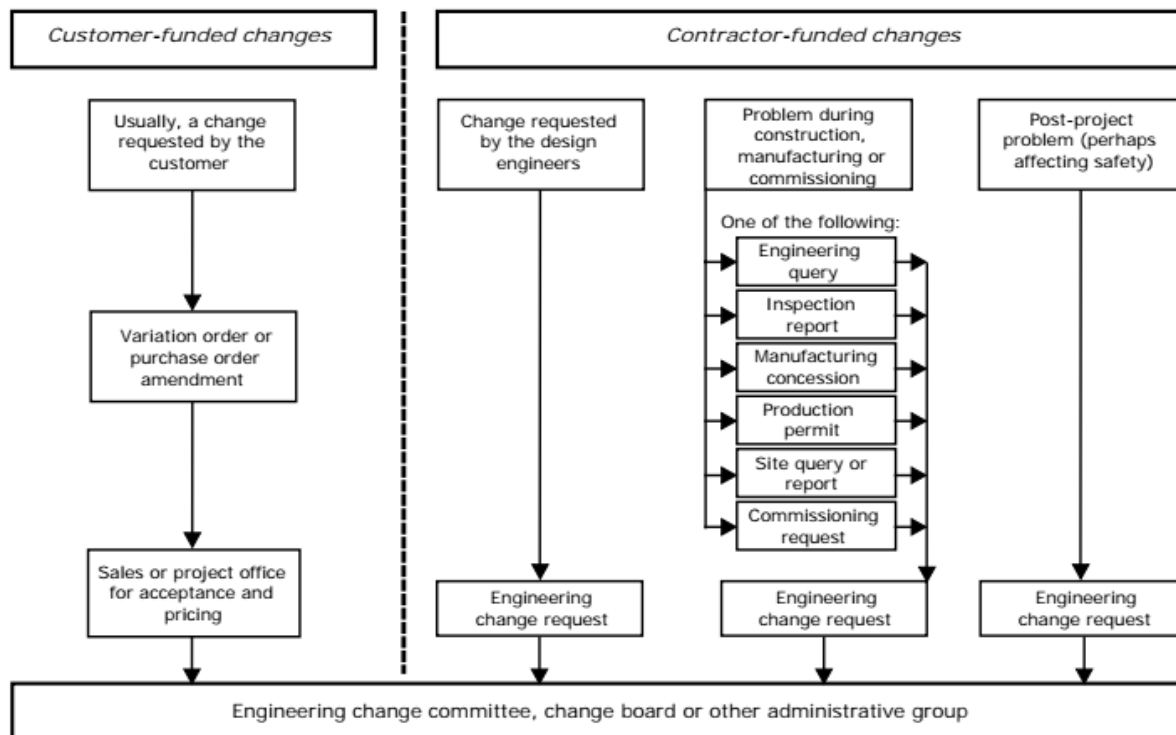
### **IMPACT OF CHANGES IN RELATION TO THE PROJECT LIFE CYCLE**

Changes are usually unwelcome to a project manager at any stage, but changes that occur towards the end of a project have the potential to cause greater cost and disruption than those which are mooted before the project begins. When a project is in its proposal or business plan stage, any proposed change in the scope or nature of the project may cause some annoyance and result in more investigations, revised financial appraisals and fresh planning. However, the same change when a project is nearing completion would be disastrous, meaning that much of the work in progress or completed would have to be scrapped and restarted. Thus it is a general rule that the later the change happens, the greater the cost and disruption it will cause. A change request is a formal proposal to modify any document, deliverable, or baseline. When issues are found while project work is being performed, change requests can be submitted, which may modify project policies or procedures, project or product scope, project cost or budget, project schedule, or quality of the project or product results. Other change requests cover the needed preventive or corrective actions to forestall negative impact later in the project. Any project stakeholder may request a change.

A more useful way of classifying changes from the commercial point of view is to label them as 'funded or 'unfunded'. For a funded change the customer must take responsibility for the change and pay for it. For unfunded changes the contractor will have to absorb all the costs, with consequent risk to budget limits and expected profits. Whether or not a change is to be funded or unfunded will greatly influence how it is considered for authorization.

**Funded changes-** Changes to the specified project requested by the customer automatically imply a corresponding change to the contract, since the project specification should form part of

the contract documentation. If, as usually happens, the modification results in an increase in the contractor's costs, a suitable change to the contract price must be negotiated. The delivery schedule may also be affected and any resulting delays must be predicted, discussed and agreed. Customer-funded modifications may possess nuisance value and can disrupt the smooth flow of logically planned work, but they do nevertheless offer the prospect of compensation through an increase in price and possibly an increase in profit. When a customer asks for a change, the contractor is in a strong price-bargaining position because there is no competitor and the contractor has a monopoly. Customer-funded changes are usually documented as purchase order amendments or contract variation orders (otherwise known as project variations). **Unfunded changes-** If a contractor finds it necessary to introduce changes for reasons unconnected with the customer, it is hardly likely that the customer could be expected to pay (unless the changes are covered by some contingency for which provision was made in the contract). The contractor must be prepared to carry the additional costs, write off any scrapped work and answer to the customer for any resulting time delay. For these reasons, contractors have to be particularly wary about allowing unfunded (which really means contractor-funded) changes to proceed. The procedure for introducing an unfunded modification into an active project usually starts by raising a document called an engineering change request, engineering change order, modification request or some permutation of these terms. Some reasons for unfunded changes are shown in Figure 25.2 and the relevant documentation.



**Fig. 5.12 Some origins of Project Changes**

**Permanent and temporary changes-** Changes can be further classified as permanent or temporary:

**Permanent changes** are carried out with the intention of leaving them permanently embodied in the design and execution of a project, and which will remain recorded in drawings and specifications to show the true as-built condition of the completed project.

**Temporary changes** may be needed for expediency in getting a project finished, but they are carried out with the intention of removing them or converting them to some alternative permanent change at a later, more convenient time.

Change requests are processed for review and disposition through the Perform Integrated Change Control process. Change requests can be initiated from inside or outside the project and they can be optional or legally/contractually mandated.

Change requests may include:

-Corrective action- An intentional activity that realigns the performance of the project work with the project management plan.

-Preventive action- An intentional activity that ensures the future performance of the project work is aligned with the project management plan.

-Defect repair- An intentional activity to modify a nonconforming product or product component.

-Updates- Changes to formally controlled project documents, plans, etc., to reflect modified or additional ideas or content.

#### **Use of standard change request forms**

Individuals who wish to request a change should always be asked to put their request in writing. This chapter is written on the assumption that all such requests will be addressed to a change committee.

Where the organization does not operate a formal change committee, a suitably senior member of the organization, such as the chief engineer, should be designated as the person responsible for considering and authorizing changes.

To save the committee's time and to ensure that all requests are properly controlled and progressed, some kind of standard change request form must be used. This form should be designed in such a way that the originator is induced to answer in advance all the questions that the change committee will want to ask. In some projects, even the customer can be persuaded to submit change requests using the contractor's standard forms.

**Scope Creep-** The uncontrolled expansion to product or project scope without adjustments to time, cost, and resources. It is the natural inclination of the funder to change the deliverables as they obtain better information about their needs over time. Scope creep is not always the fault of the funder, however; sometimes the team members themselves, in an effort to do their best work, unwittingly increase the scope of the project. The PM must be constantly on guard to identify such changes. Scope creep arises just because of two reasons: (1) stakeholders only being consulted at the beginning of the project and (2) requirements changing due to new information about the needs of the project. New technologies become available or better ideas occur to the team as work progresses. The later these changes are made in the project, the more difficult and costly they are to complete. It recommends the PMs to frame the project in such a way that sponsors and clients can see for themselves what the trade-offs of a desired scope change are. Instead of telling the client "No," say "Sure, we can change the design. I'll get back to you with the schedule and budget impact of this change." continuing accumulation of little changes can have a major negative impact on the project's schedule and cost.

Control of scope creep is accomplished with a formal *change control system*, which, in some industries, is a part of their *configuration management system* responsible for integrating and coordinating changes throughout the systems development cycle. The purpose of the formal change control system is to

- review all requested changes to the project (both content and procedures)



- identify all task impacts
- translate these impacts into project scope, cost, and schedule
- evaluate the benefits and costs of the requested changes
- identify alternative changes that might accomplish the same ends
- accept or reject the requested changes
- communicate the changes to all concerned parties
- ensure that the changes are implemented properly
- prepare monthly reports that summarize all changes to date and their project impacts

The following simple guidelines, applied with reasonable rigor, can be used to establish an effective change control procedure. The guidelines can also be integrated into the risk management system as a way to manage the risks imposed by scope creep.

1. All project contracts or agreements must include a description of how requests for a change in the project's plan, budget, schedule, and/or deliverables will be introduced and processed.
2. Once a project is approved, any change in the project will be in the form of a *change order* that will include a description of the agreed-upon change together with any changes in the plan, budget, schedule, and/or deliverables that result from the change. For any but minor changes, a risk identification and analysis study should be performed. In order to study the potential impact of change, it is often possible to conduct a simulation study.
3. The PM must be consulted on all desired changes prior to the preparation and approval of the change order. The PM's approval, however, is not required.
4. Changes must be approved, in writing, by the client's agent as well as by an appropriate representative of senior management of the firm responsible for carrying out the project.
5. Once the change order has been completed and approved, the project plan should be amended to reflect the change, and the change order becomes a part of the project plan.

The process of controlling change is not complicated. If the project is large, a change control board needs to be constituted. This is a group representing all interested parties that processes all requests for change. For the typical small- or medium-sized project, however, the problem of handling change need not be complex. The main source of trouble is that too many PMs, in an attempt to avoid anything that smacks of bureaucracy, adopt an informal process of handling requests for change. Misunderstanding often arises from this informality, and the PM finds that the project becomes committed to deliver a changed output of extended scope, but will have to swallow the additional cost involved, and will have to scramble to meet the old, unchanged schedule.

The problems associated with dealing with change orders informally are particularly severe in the case of software and information system projects. The severity of the problem of dealing with change in software projects, it seems to us, is caused by two interrelated factors. First, software and information systems experts too often fail to explain adequately to the client the real nature of the systems they develop. Second, clients too often fail to make an adequate effort to understand the systems that become the lifeblood for their organizations. The development of *Agile* approaches for managing IT projects, or the use of the formal process for change suggested above, should help to reduce the degree of misunderstanding and disappointment.

**Project audit-** The project audit is a thorough examination of the management of a project, its methodology and procedures, its records, its properties, its budgets and expenditures, and its degree of completion. It may deal with the project as a whole or only with a part of the project. The formal report may be presented in various formats but should, at a minimum, contain comments on the following points:

1. **Current status of the project.** Does the work actually completed match the planned level of

completion?

**2. Future status.** Are significant schedule/cost/scope changes likely? If so, indicate the nature of the changes.

**3. Status of crucial tasks.** What progress has been made on tasks that could decide the success or failure of the project?

**4. Risk assessment.** What is the potential for project failure or monetary loss?

**5. Information pertinent to other projects.** What lessons learned from the project being audited can be applied to other projects being undertaken by the organization?

**6. Limitations of the audit.** What assumptions or limitations affect the data in the audit?

Note that the project audit is not a financial audit. The audit processes are similar in that each represents a careful investigation of the subject of the audit, but the outputs of these processes are quite different. The principal distinction between the two is that the financial audit has a limited scope. It concentrates on the use and preservation of the organization's assets. The project audit is far broader in scope and may deal with the project as a whole or any component or set of components of the project. Table 5.2 lists the primary differences between financial and project audits.

**Table 5.2 Difference between Financial Audit and Project Audit**

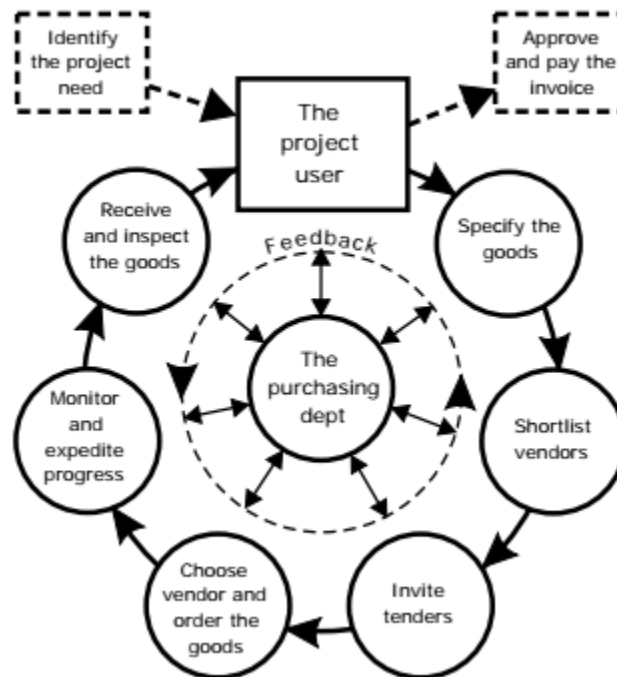
Criteria	Financial Audit	Project Audit
Status	Confirms status of business in relation to accepted standard	Must create basis for, and confirm, status on each project
Predictions	Company's state of economic well-being	Future status of project
Measurement	Mostly in financial terms	Financial terms plus schedule, progress, resource usage, status of ancillary goals
Record-keeping system	Format dictated by legal regulations and professional standards	No standard system, uses any system desired by individual organization or dictated by contract
Existence of information system audit	Minimal records needed to start audit	No records exist, data bank must be designed and used to start audit
Recommendations	Usually few or none, often restricted to management of accounting system	Often required, and may cover any aspect of the project or its management
Qualifications to the audit report	Customary to qualify statements if conditions dictate, but strong managerial pressure not to do so	Qualifications focus on shortcomings of audit process (e.g., lack of technical expertise, lack of funds or time)

While the project audit may be concerned with any aspect of project management, it is not a traditional management audit. Management audits are primarily aimed at ensuring that the organization's management systems are in place and operative. The project audit goes beyond this. Among other things, it is meant to ensure that the project is being *appropriately* managed. To sum up, the management audit looks at managerial systems and their use. The project audit studies the financial, managerial, and technical aspects of the project as an integrated set applied to a specific project in a specific organizational environment.

### 5.3 Project Contracting:

Project authorization by a contractor usually means that the contractor has been instructed by the owner, customer or client to proceed with the project on terms that have previously been negotiated and agreed. This instruction might be received in the form of a contract, a purchase order or (less desirably) a letter of intent.

The resulting authorization document issued within the contracting company might be entitled 'project authorization' or perhaps 'works order'. This document carries essential data that define the levels of expenditure authorized (the departmental and purchasing cost budgets), planned start and finish dates, details of the customer's order, pricing information, invoicing and delivery instructions and so on.



**Fig. 5. 13 Cycle of project contracting**

One vital item on a project authorization is the signature of a member of the contractor's senior management. That is the signal that the project is properly authorized, that work can begin and that costs can be incurred or committed.

The data in project authorizations are usually summarized, often to the extent that all the information can be printed on one side of an A4 page. This can be true even for large capital projects. Precise project definition is achieved by listing the relevant technical and commercial documents on the authorization form. If, for example, the project has been won after in-depth negotiation of a detailed contract, coupled with the discussion of technical and commercial sales specifications, the project authorization must identify those documents without ambiguity by giving their serial numbers and all approved amendments or revision numbers.

#### **The golden rule**

One of the things that all managers are taught is that no expense shall be committed on any project unless the customer's written authority to proceed (and promise to pay) has first been obtained. The risks for disobeying this rule are obvious. Once the customer knows that the contractor has already become committed to actual costs, the contractor's bargaining position in

contract negotiations has been weakened. Worse still, if the customer decides not to go ahead with the project or give the work to another company, all the contractor's committed costs will be forfeit. For these good reasons, an internal project authorization document will not normally be issued unless the customer's written authority to proceed has been obtained.

### **Breaking the rule**

In spite of convention, there might be occasions when a very limited amount of work can be authorized before receipt of a firm order from the customer. This poses risks. Indeed, to many work hardened managers it will sound like heresy. Nevertheless, provided the risks can be quantified and contained within controlled limits it is often possible to gain several weeks' progress in the project calendar for the expenditure of only a tiny fraction of the total project cost. Of course, no orders for materials can be placed, but it might be possible to carry out activities from a preliminary project start-up checklist without committing more than one or two people over the limited period concerned.

Naturally, such advance work in the absence of a customer order will only be authorized where this strategy has advantages for the contractor. These advantages might include the avoidance of possible trouble later on, if the overall project timescale is seen to be particularly tight. If the contractor foresees a trough in the organization's total workload, it could suit the contractor to carry out a little preliminary work, to enable full-scale work on the new project to start as soon as the order is received. By these methods, progress on a new project might be pulled forward by a month or two.

Conversely, doing absolutely nothing and waiting until the official order is received from the customer could mean that the main project workload will be delayed until it interferes with work for other projects.

Graphs of project expenditure plotted against time display a characteristic S shape. The rate of expenditure usually starts very slowly, increases greatly during the middle part of the project life cycle, and then falls off as the project nears completion. Any talk of authorizing advance expenditure must be limited to the first few weeks, when the rate of expenditure is very low and confined to preliminary engineering or administrative tasks. Steps must be taken to ensure that the expenditure rate remains low. Any decision to allow advance work is always risky, and this must be reflected in the conditions listed in the authorizing document. A preliminary issue of the project authorization can be used but only with the following provisos:

- Authorization must be limited to allow only one or two named individuals to do the work.
- The project accounting system should be programmed to reject time booked by people who are not on the authorized list.
- No materials or equipment must be ordered.
- There must be a total budget allocation for this work, regarded as the 'write-off' value of the risk.
- The work to be done should be defined and confined by a checklist or schedule.
- Progress and costs must be monitored and reported to senior management so that work can be stopped immediately at any time.

### **5.3.1 Project procurement management**

Project Procurement Management includes the processes to purchase or acquire the products, services, or results needed from outside the project team to perform the work. This chapter presents two perspectives of procurement. The organization can be either the buyer or seller of the product, service, or results under a contract. Project Procurement Management includes the

contract management and change control processes required to administer contracts or purchase orders issued by authorized project team members. Project Procurement Management also includes administering any contract issued by an outside organization (the buyer) that is acquiring the project from the performing organization (the seller), and administering contractual obligations placed on the project team by the contract. Figure 5.14 provides an overview of the Project Procurement Management processes and the processes and their inputs, outputs, and related processes from other Knowledge Areas. The Project Procurement Management processes include the following:

- 1. Plan Purchases and Acquisitions** – determining what to purchase or acquire and determining when and how.
- 2. Plan Contracting** – documenting products, services, and results requirements and identifying potential sellers.
- 3. Request Seller Responses** – obtaining information, quotations, bids, offers, or proposals, as appropriate.
- 4. Select Sellers** – reviewing offers, choosing among potential sellers, and negotiating a written contract with each seller.
- 5. Contract Administration** – managing the contract and relationship between the buyer and seller, reviewing and documenting how a seller is performing or has performed to establish required corrective actions and provide a basis for future relationships with the seller, managing contract-related changes and, when appropriate, managing the contractual relationship with the outside buyer of the project.
- 6. Contract Closure** – completing and settling each contract, including the resolution of any open items, and closing each contract applicable to the project or a project phase.

The Project Procurement Management processes involve contracts that are legal documents between a buyer and a seller. A contract is a mutually binding agreement that obligates the seller to provide the specified products, services, or results, and obligates the buyer to provide monetary or other valuable consideration. A contract is a legal relationship subject to remedy in the courts. The agreement can be simple or complex, and can reflect the simplicity or complexity of the deliverables. A contract includes terms and conditions, and can include other items such as the seller's proposal or marketing literature, and any other documentation that the buyer is relying upon to establish what the seller is to perform or provide. It is the project management team's responsibility to help tailor the contract to the specific needs of the project. Depending upon the application area, contracts can also be called an agreement, subcontract, or purchase order. Most organizations have documented policies and procedures specifically defining who can sign and administer such agreements on behalf of the organization. Although all project documents are subject to some form of review and approval, the legally binding nature of a contract usually means that it will be subjected to a more extensive approval process. In all cases, the primary focus of the review and approval process ensures that the contract language describes products, services, or results that will satisfy the identified project need. In the case of major projects undertaken by public agencies, the review process can include public review of the agreement. The project management team may seek support early from specialists in the

disciplines of contracting, purchasing, and law. Such involvement can be mandated by an organization's policy. The various activities involved in the Project Procurement Management processes form the life cycle of a contract. By actively managing the contract life cycle and carefully wording the terms and conditions of the contract, some identifiable project risks can be avoided or mitigated. Entering into a contract for products or services is one method of allocating the responsibility for managing or assuming potential risks.

A complex project can involve managing multiple contracts or subcontracts simultaneously or in sequence. In such cases, each contract life cycle can end during any phase of the project life cycle. Project Procurement Management is discussed within the perspective of the buyer-seller relationship. The buyer-seller relationship can exist at many levels on any one project, and between organizations internal to and external to the acquiring organization. Depending on the application area, the seller can be called a contractor, subcontractor, vendor, service provider, or supplier. Depending on the buyer's position in the project acquisition cycle, the buyer can be called a client, customer, prime contractor, contractor, acquiring organization, governmental agency, service requestor, or purchaser. The seller can be viewed during the contract life cycle first as a bidder, then as the selected source, and then as the contracted supplier or vendor.

The seller will typically manage the work as a project if the acquisition is not just for materiel, goods, or common products. In such cases: -

- Buyer becomes the customer, and is thus a key project stakeholder for the seller
- Seller's project management team is concerned with all the processes of project management, not just with those of this Knowledge Area
- Terms and conditions of the contract become key inputs to many of the seller's management processes. The contract can actually contain the inputs (e.g., major deliverables, key milestones, cost objectives), or it can limit the project team's options (e.g., buyer approval of staffing decisions is often required on design projects).

It is assumed that the buyer of items for the project is within the project team and that the seller is external to the project team. This relationship is true if the performing organization is the seller of a project to a customer. This relationship is also true if the performing organization is the buyer from other vendors or suppliers of products, services, results, or subproject components used on a project.

It is also assumed that a formal contractual relationship is developed and exists between the buyer and the seller. However, most of the discussion in this chapter is equally applicable to non-contractual formal agreements entered into with other units of the project team's organizations.

### **5.3.2 Contracting and outsourcing:-**

#### **Plan Contracting**

The Plan Contracting process prepares the documents needed to support the Request Seller Responses process and Select Sellers process.

#### **Plan Contracting: Inputs**

**1. Procurement Management Plan-** Already discussed.

**2. Contract Statement of Work-** Already discussed

**3. Make-or-Buy Decisions** -The make-or-buy decisions are documented in the issued list of items to be purchased or acquired and those items to be produced by the project team.



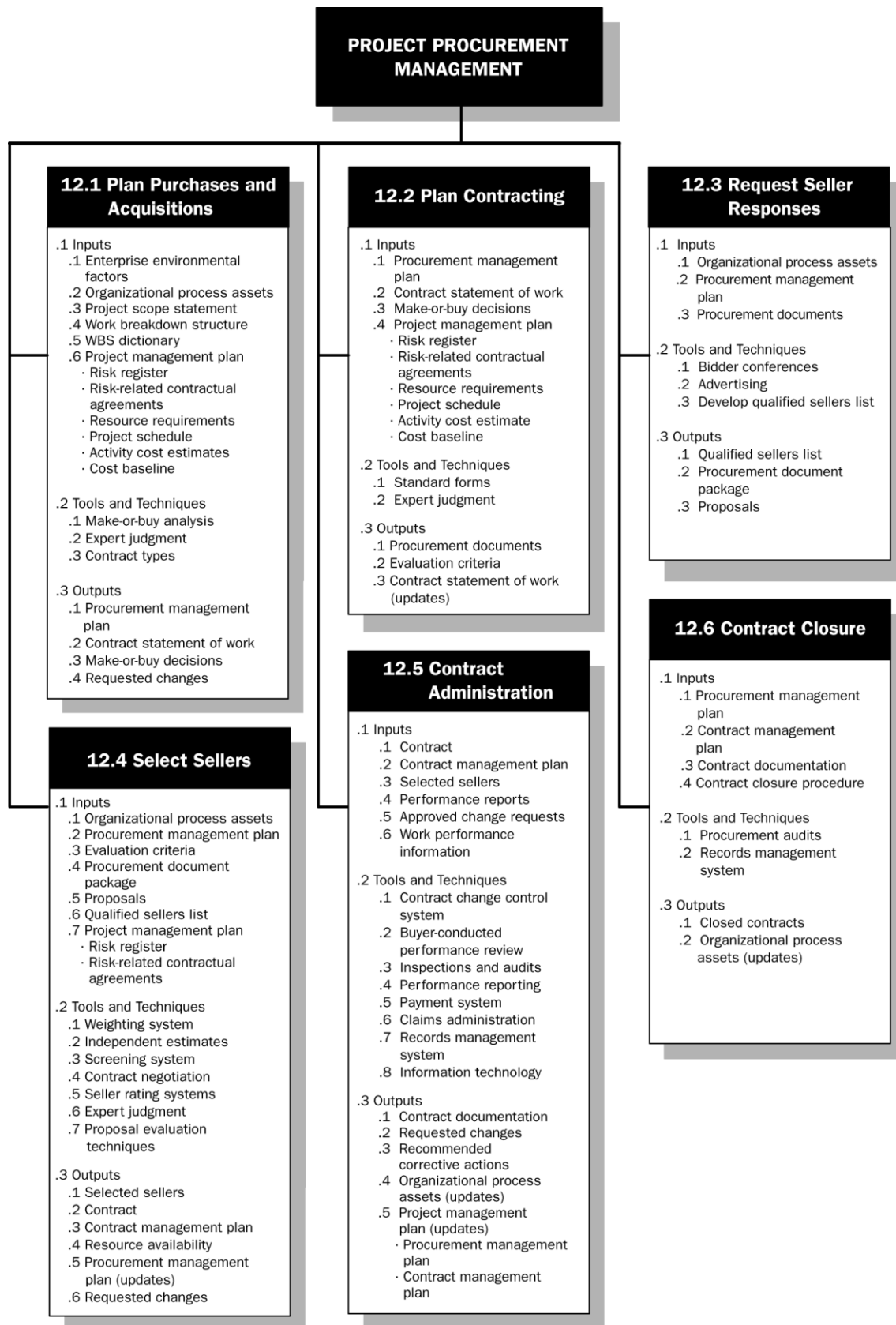


Fig. 5.14 Project Procurement Management Overview

**4. Project Management Plan** -The project management plan provides other planning output documents, which may have been modified and may need to be reviewed again as part of the procurement documentation development. In particular, development of procurement documentation is closely aligned with scheduled delivery dates in the project schedule.

**-Risk register-** Contains risk-related information such as the identified risks, root causes of risks, risk owners, risk analyses results, risk prioritization, risk categorization, and risk responses generated by the risk management processes.

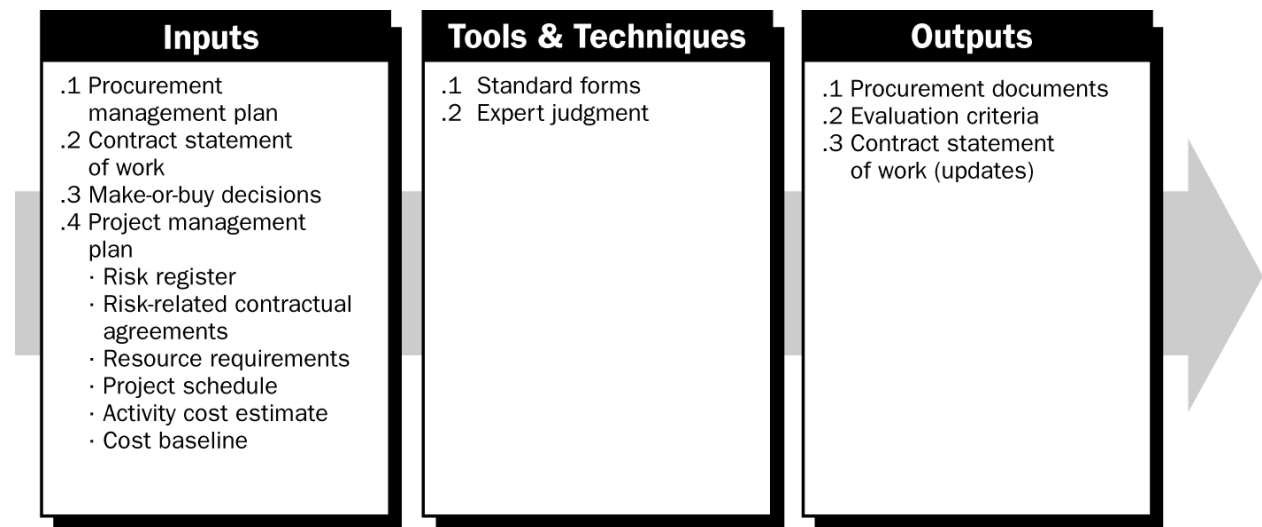
**-Risk-related contractual agreements** -Includes agreements for insurance, services, and other items as appropriate that are prepared to specify each party's responsibility for specific risks, should they occur.

**-Activity resource requirements** - Already discussed

**-Project schedule** - Already discussed

**-Activity cost estimates-** Already discussed

**-Cost baseline**



**Fig. 5.15 Plan Contracting: Inputs, Tools & Techniques, and Outputs**

### Plan Contracting: Tools and Techniques

#### 1. Standard Forms

Standard forms include standard contracts, standard descriptions of procurement items, non-disclosure agreements, proposal evaluation criteria checklists, or standardized versions of all parts of the needed bid documents. Organizations that perform substantial amounts of procurement can have many of these documents standardized. Buyer and seller organizations performing intellectual property transactions ensure that non-disclosure agreements are approved and accepted before disclosing any project specific intellectual property information to the other party.

**2. Expert Judgment-** Already discussed

### Plan Contracting: Outputs

#### 1. Procurement Documents

Procurement documents are used to seek proposals from prospective sellers. A term such as bid, tender, or quotation is generally used when the seller selection decision will be based on price (as

when buying commercial or standard items), while a term such as proposal is generally used when other considerations, such as technical skills or technical approach, are paramount. However, the terms are often used interchangeably and care is taken not to make unwarranted assumptions about the implications of the term used. Common names for different types of procurement documents include invitation for bid, request for proposal, request for quotation, tender notice, invitation for negotiation, and contractor initial response. The buyer structures procurement documents to facilitate an accurate and complete response from each prospective seller and to facilitate easy evaluation of the bids. These documents include a description of the desired form of the response, the relevant contract statement of work and any required contractual provisions (e.g., a copy of a model contract, non-disclosure provisions). With government contracting, some or all of the content and structure of procurement documents can be defined by regulation.

The complexity and level of detail of the procurement documents should be consistent with the value of, and risk associated with, the planned purchase or acquisition. Procurement documents are rigorous enough to ensure consistent, comparable responses, but flexible enough to allow consideration of seller suggestions for better ways to satisfy the requirements. Inviting the sellers to submit a proposal that is wholly responsive to the request for bid and to provide a proposed alternative solution in a separate proposal can do this.

Issuing a request to potential sellers to submit a proposal or bid is done formally in accordance with the policies of the buyer's organization, which can include publication of the request in public newspapers, in magazines, in public registries, or on the Internet.

**2. Evaluation Criteria-** Evaluation criteria are developed and used to rate or score proposals. They can be objective or subjective. Evaluation criteria are often included as part of the procurement documents. Evaluation criteria can be limited to purchase price if the procurement item is readily available from a number of acceptable sellers. Purchase price in this context includes both the cost of the item and ancillary expenses such as delivery. Other selection criteria can be identified and documented to support an assessment for a more complex product or service. For example:

**-Understanding of need.** How well does the seller's proposal address the contract statement of work?

**-Overall or life-cycle cost.** Will the selected seller produce the lowest total cost (purchase cost plus operating cost)?

**-Technical capability.** Does the seller have, or can the seller be reasonably expected to acquire, the technical skills and knowledge needed?

**-Management approach.** Does the seller have, or can the seller be reasonably expected to develop, management processes and procedures to ensure a successful project?

**-Technical approach.** Do the seller's proposed technical methodologies, techniques, solutions, and services meet the procurement documentation requirements or are they likely to provide more than the expected results?

**-Financial capacity.** Does the seller have, or can the seller reasonably be expected to obtain, the necessary financial resources?

**-Production capacity and interest.** Does the seller have the capacity and interest to meet potential future requirements?

**-Business size and type.** Does the seller's enterprise meet a specific type or size of business, such as small business, women-owned, or disadvantaged small business, as defined by the buyer or established by governmental agency and set as a condition of being award a contract? -

**References.** Can the seller provide references from prior customers verifying the seller's work experience and compliance with contractual requirements?

**-Intellectual property rights.** Does the seller assert intellectual property rights in the work processes or services they will use or in the products they will produce for the project? -

**Proprietary rights.** Does the seller assert proprietary rights in the work processes or services they will use or in the products they will produce for the project?

### **3. Contract Statement of Work (Updates)**

Modifications to one or more contract statements of work can be identified during procurement documentation development.

### **Outsourcing or purchase from Sellers**

The Request of Outsourcing Responses process obtains responses, such as bids and proposals, from prospective outsourcings on how project requirements can be met. The prospective outsourcings, normally at no direct cost to the project or buyer, expend most of the actual effort in this process.

#### **Request Outsourcing Responses: Inputs**

##### **1. Organizational Process Assets**

Some organizations, as part of their organizational process assets, maintain lists or files with information on prospective and previously qualified outsourcings, sometimes called bidders, who can be asked to bid, propose, or quote on work. These lists will generally have information on relevant past experience and other characteristics of the prospective outsourcings. Some organizations maintain preferred outsourcings lists that include only outsourcings already selected through some qualification methodology.

**2. Procurement Management Plan-** Already discussed.

**3 Procurement Documents -** Already discussed.

#### **Request Seller Responses: Tools and Techniques**

**1 Bidder Conferences-** Bidder conferences (also called contractor conferences, vendor conferences, and pre-bid conferences) are meetings with prospective sellers prior to preparation of a bid or proposal. They are used to ensure that all prospective sellers have a clear, common understanding of the procurement (e.g., technical requirements and contract requirements). Responses to questions can be incorporated into the procurement documents as amendments. All potential sellers are given equal standing during this initial buyer and seller interaction to produce the best bid.

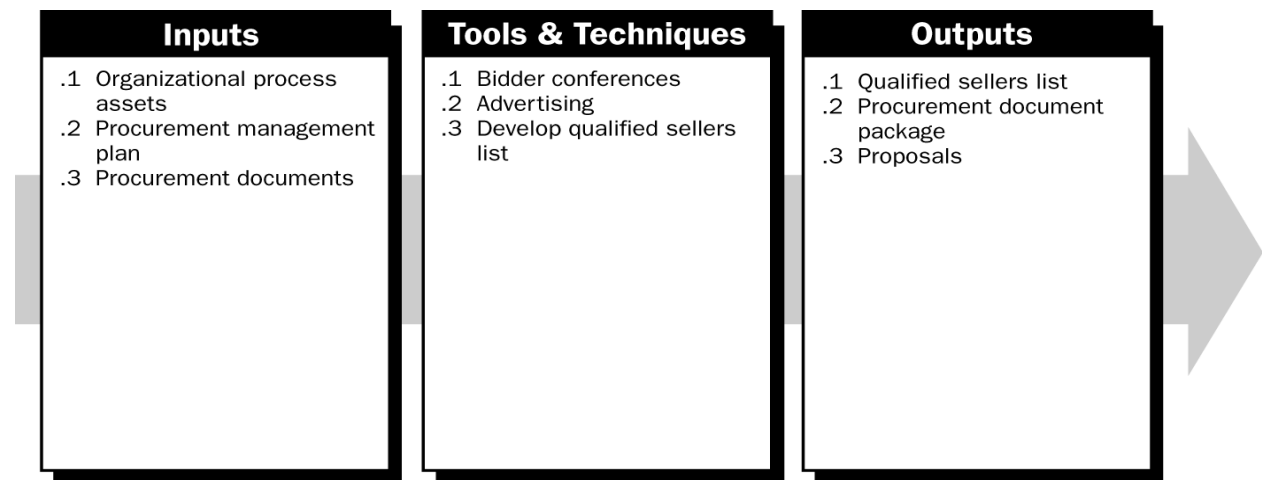
**2 Advertising-** Existing lists of potential sellers can often be expanded by placing advertisements in general circulation publications such as newspapers or in specialty publications such as professional journals. Some government jurisdictions require public advertising of certain types of procurement items; most government jurisdictions require public advertising of pending government contracts.

**3 Develop Qualified Sellers List-** Qualified sellers lists can be developed from the organizational assets if such lists or information are readily available. Whether or not that data is available, the project team can also develop its own sources. General information is widely available through the Internet, library directories, relevant local associations, trade catalogs, and similar sources. Detailed information on specific sources can require more extensive effort, such as site visits or contact with previous customers. Procurement documents can also be sent to determine if some or all of the prospective sellers have an interest in becoming a qualified potential seller.

### 12.3.3 Request Seller Responses: Outputs

**1 Qualified Sellers List-** The qualified sellers list are those sellers who are asked to submit a proposal or quotation.

**2 Procurement Document Package-** The procurement document package is a buyer-prepared formal request sent to each seller and is the basis upon which a seller prepares a bid for the requested products, services, or results that are defined and described in the procurement documentation.



**Fig. 5.16 Request Outsourcing Responses: Inputs, Tools & Techniques, and Outputs**

### Earned Value Analysis- Example

#### Objective:

- To measure the progress of an activity, deliverable and/or project by comparing the actual value to planned value, thereby indicating the probability of meeting the scope, time & cost budget of the activity, deliverable and/or project, and need for any corrective actions.
- To analyze the project performance, calculate the variance for schedule and cost and indicates where the project stands in comparison to the estimates calculated earlier for this point in time.

Many a times one could easily be on time, however may overspend, or may be on time & within budget however scope may be incomplete. In simple terms, EV analysis is better than comparing actual to planned results or by simply guessing the project status.

#### Definitions

Planned Value (PV) or Budgeted Cost of Work Scheduled (BCWS)	Originally planned cost of the work that should have been done by this time
Actual Cost (AC) or Actual Cost of Work Performed (ACWP)	Actual cost expenses on this project upto this time
Earned Value (EV) or Budgeted cost of Work Performed (BCWP)	Estimated cost of budgeted work completed
Budget at Completion (BAC)	Total budget for the project
Estimate At Completion (EAC)	Estimated final cost of the project
Estimate To Completion (ETC)	Estimated cost of the remaining work of the project

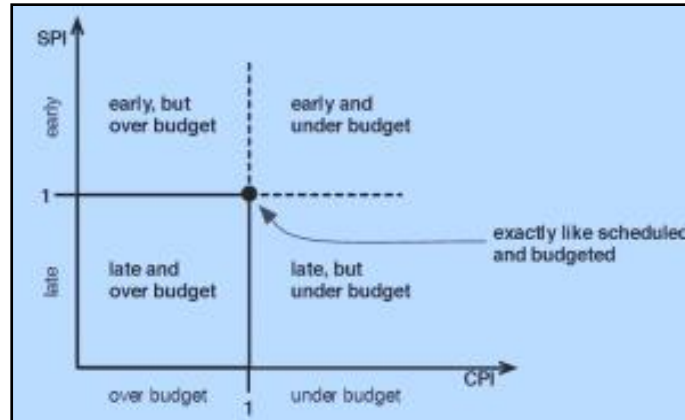
Description	EVA Formulas	Result
Cost Variance (CV)	$CV = EV - AC$	Positive value is good. Negative value unfavorable.
Schedule Variance (SV)	$SV = EV - PV$	Value below 1.0 = below par performance. Value above 1.0 = above par performance The further away the ratio is from 1.0 the more urgent need to investigate
Cost Performance Indicator (CPI)	$CPI = EV / AC$ , compares performed to actual cost	>1 means project efficient, <1 means project inefficient
Schedule Performance Indicator (SPI)	$SPI = EV / PV$ , compares work performed to work planned	>1 means project ahead of schedule, <1 means project behind schedule
Estimate At Completion (EAC)	$EAC = BAC / CPI$	
Estimate To Complete (ETC)	$ETC = (BAC - EV) / CPI$	

**Example**

Assume a project that has exactly one task. The task was baselined at 100 hours, but 110 hours have been spent and the estimate to complete is 10 additional hours. The task was to have been completed already. Assume an hourly rate of \$100 per hour.

Description	Formulae	Result
PV	Hourly Rate * Total Hours Planned or Scheduled	$100 * 100 = 10,000$
AC	Hourly Rate * Total Hours Spent	$100 * 110 = 11,000$
% Complete	AC divided by estimated cost at completion which is 11,000 plus cost of 10 additional hours	$11000 / (11000 + 1000) = 91.667\%$
EV	Baselined Cost * % Complete Actual	9166.667 (baseline of 10,000 * 91.667% complete)
BAC	Baselined Effort in hours * Hourly Rate	10000 (100 hours * 100) <i>indicates initially budget signed off for the project</i>
EAC	$AC + ETC$	12000 (11000 + 1000) <i>notice this is over budget</i>
VAC	$BAC - EAC$	-2000 (10000 – 12000) <i>indicates additional funds required to complete work</i>
% Completed Planned	$PV / BAC$	100% (10000/10000)
% Completed Actual	$AC / EAC$	91.7% (11000/12000) <i>lesser than planned completion</i>
SV	Earned Value (EV) – Planned Value (PV)	-833.33 (9166.667 – 10000) <i>negative schedule variance or behind schedule</i>
SPI	$SPI = EV / PV$	0.9167 (9166.667 / 10000) <i>indicating poor schedule performance</i>
CV	Earned Value (EV) – Actual Cost (AC)	-1.833.33 (9166.67 – 11000) <i>indicating a cost overrun</i>
CPI	Earned Value (EV) / Actual Cost (AC)	0.833 (9166.667 / 11000) <i>indicating over budget</i>





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Module-5 Executing Projects- Monitoring & Controlling, Contracting (Question Bank)

1. What are routine, exception and special analysis reports used for? Why meetings are useful in project monitoring? What rules should be followed to maximize effectiveness of meetings?
  2. Draw an Earned value chart and describe the three variances of it and explain their significance.
  3. What is the purpose of control in project management? What are the three main types of control system? What are characteristics of a good control system?
  4. What is a scope creep? How does formal change control system works in project management?
  5. What does project audit tries to find out? How do project audit recommendations help the project? What are types of project audits based on the depth of audit?
  6. What is the life cycle of a project audit? What are responsibilities of project auditor? What is essential for successful project audit?
  7. Briefly describe the purchasing cycle.
  8. What is a contract? What does it include? What are centralized and decentralized contracts? Explain their advantages and disadvantages.
  9. What are different types of contracts type? Draw the graph showing risk exposure to buyer and seller in various contract types?
  10. What is stock purchasing and Project purchasing? In which situations these are respectively preferred?
  11. What is importance of vendor documents? How the vendor documents should be preserved?
  12. What is a Risk breakdown structure? How the impact scales are defined for various project objectives?
  13. Explain Probability and impact matrix. What are the risk response strategies for negative risks(threats) and positive risks(opportunities)
  14. What are four stages of team development and growth? What are advantages of effective team? What are barriers to team effectiveness?
  15. What are the essential characteristics of effective team members and discuss the project managers responsibilities toward the project team members
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