UNIT 4 PROJECT PLANNING

Objectives

The objectives of this unit are:

- to provide an understanding of nature and types of projects,
- to throw light on project life cycle,
- to explain how project work is planned.

Structure

4.1 INTRODUCTION

Effective management of projects is key to the progress of an economy because development itself is the outcome of a series successfully managed projects. This is why project management is receiving greater attention in developing countries like ours, so as to avoid project schedule slippages and cost overruns, a project needs to be meticulously planned, effectively implemented and professionally managed in order to accomplish the objectives of time, cost and performance. This demands fairly good understanding of nature and types of projects, project life cycle and concept of project management.

4.2 NATURE OF A PROJECT

The term 'project' has a wider meaning to include a set of activities. For example, construction of a house is a project. It includes many activities like digging of foundation pits, construction of foundations, construction of walls, construction of roof, fixing of doors and windows, fixing of sanitary fitting, wiring etc. Further, project is the non-routine nature of activities.

In fact, a project is an organized programme of pre-determined group of activities that are non-routine in nature and that must be completed within the given time limit. It is a non-routine, non-repetitive, one-off undertaking, normally with discrete time, financial and technical performance goals.

The distinguishing features of a project are :

- **Purpose:** A project is usually a one-time activity with a well-defined set of desired end results. It can be divided into subtasks that must be accomplished in order to achieve the project goals. The project is complex

enough that the subtasks require careful coordination and control in terms of timing, precedence, cost, and performance. The project itself must often be coordinated with other projects being carried out by the same parent organization.

- **Life Cycle :** Like organic entites, projects have a life cycle. From a slow beginning they progress to a buildup of size, then peak, begin a decline, and finally must be terminated. (Also like other organic entities, they often resist termination.) Some projects end by being phased into the normal, ongoing operations of the parent organization.
- **Single Entity :** A project is one entity and is normally entrusted in one responsibility centre while the participants in the project are many.
- **Interdependencies :** Projects often interact with other projects carried out simultaneously by their parent organization; but projects always interact with the parent's standard, ongoing operations. While the functional departments of an organization (marketing, finance, manufacturing, and the like) interact with one another in regular, patterned ways, the patterns of interaction between projects and these departments tend to be changing. Marketing may be involved at the beginning and end of a project, but not in the middle. Manufacturing may have major involvement throughout. Finance is often involved at the beginning and accounting (the controller) at the end, as well as at periodic reporting times. The project manager must keep all these interactions clear and maintain the appropriate interrelationships with all external groups.
- **Uniqueness :** Every project has some elements that are unique. No two construction or R&D projects are precisely alike. Though it is clear that construction projects are usually more routine than research and development projects, some degree of customization is a distinct feature of a project. In addition to the presence of risk, as noted above, a project may be unique in nature, which can not be completely reduced to routine. The project manager's importance is emphasized because, as a devotee of management by exception, the manager will find there are a great many exceptions to manage by.
- **Complexity :** A rich project represents complex set of activities pertaining to diverse areas. Technology survey, choice of the appropriate technology, procuring the appropriate machinery and equipment, hiring the right kind of people, arranging the financial resources, execution of the projects in time by proper scheduling of various activities contribute to the complexity of the project.
- **Team Work :** Successful completion of a project calls for teamwork. The team is constituted of members who are specialists in relevant fields.
- **Risk and Uncertainty :** Risk and uncertainty are inherent in every project. However, degree of risk and uncertainty will depend on how a project passes through its various life cycle phases.
- **Customer Specific :** A project has always to be customer specific so as to cater to the needs of customers. As such, the organization should go for projects that are suited to customers.

4.3 CLASSIFICATION OF PROJECTS

Much of what project will comprise and consequently its management depends essentially on the category it belongs to. Projects can be categorized according to type of activity, location, time, ownership, size and need.

- **According to Type of Activity :** Under this category, projects can be classified as industrial and non-industrial projects **Industrial projects** are set up for the production of some goods. **Non-Industrial projects** comprise

health care projects, educational projects, irrigation projects, soil conservation projects, highway projects etc.

- **According to Location :** Location wise, projects can be categorized as national and international projects. **National projects** are those set up in the national boundaries of a country, while **international projects** are set up by the government of private sector across the globe.
- **According to Completion Time :** Projects under this category can be divided into two types, viz; normal and crash projects. In case of **normal projects** there is no time constraint. Crash projects are those which are to be completed within a stipulated time, even at the cost of ending up with a higher project cost.
- **According to Ownership :** Projects under this category can be grouped into public, private and joint sector projects. **Public sector projects** are owned by the Government. In **private sector projects** ownership is in the hands of the project promoters and investors. **Joint sector projects** are those in which ownership is shared by the Government and private entrepreneurs.
- **According to Size :** Based on size, there may be three categories of projects, viz; small, medium and large. As per the present guideline of the Government, projects with investment on plant and machinery upto Rs. 1 crore are classified as **small** and those with investment in plant and machinery above Rs. 100 crores are categorized as **large scale projects**. Those with investment limit between these groups are **medium scale projects.**
- **According to Need :** Based on the need for the project, projects can be classified as new balancing, expansion, modernization, replacement, diversification, backward integration and forward integration projects.

4.4 THE PROJECT LIFE CYCLE

Most projects go through similar stages on the path from origin to completion. We define these stages, as shown in Figure 4.1, as the project's life cycle. The projec is born (its start-up phase) and a manager is selected, the project team and initial resources are assembled, and the work program is organized. The work gets under way and momentum quickly builds. Progress is made. This continues until the end is in sight. But completing the final tasks seems to take an inordinate amount of time, partly because there are often a number of parts that must come together and partly because team members "drag their feet" for various reasons and avoid the final steps.

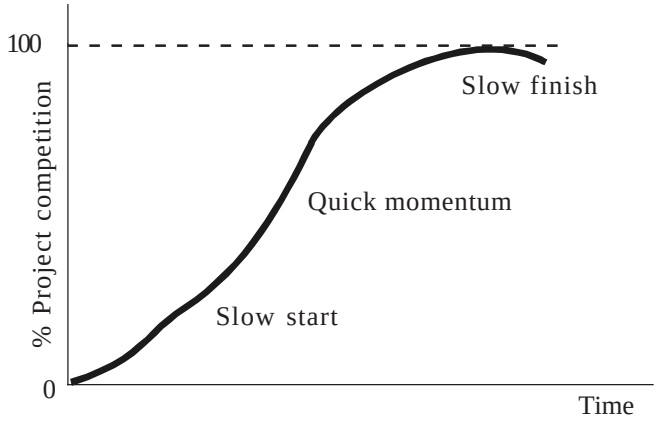

Figure 4.1: The Project Cycle

The pattern of slow-rapid-slow progress toward the project goal is common. Anyone who has watched the construction of a home or building has observed this phenomenon. For the most part, it is a result of the changing levels of resources used during the successive stages of the life cycle. Figure 4.2 depicts project effort, usually in terms of man-hours or resouces expended per unit of time (or number of people working on the project) plotted against time, where time is broken up into the several phases of project life. Minimal effort is required at the beginning-when the project concept is being developed and is being subjected to project selection processes.

If this hurdle is passed, activity rate increases as planning is done, and the real work of the project gets under way. This rises to a peak and then begins to taper off as the poject nears completion, finally ceasing when evaluation is complete and the project is terminated. In some cases, the effort may never fall to zero because the project team, or at least a cadre group, may be maintained for the next appropriate project that comes along. The new project will then emerge.

The ever-present goals of performance, time, and cost are the major considerations throughout the project's life cycle. Early in the life cycle, performance takes precedence. Team members focus on how to achieve the project's performance goals. We refer to the specific methods adopted to reach these goals as the project's technology because these methods require the application of a science or art.

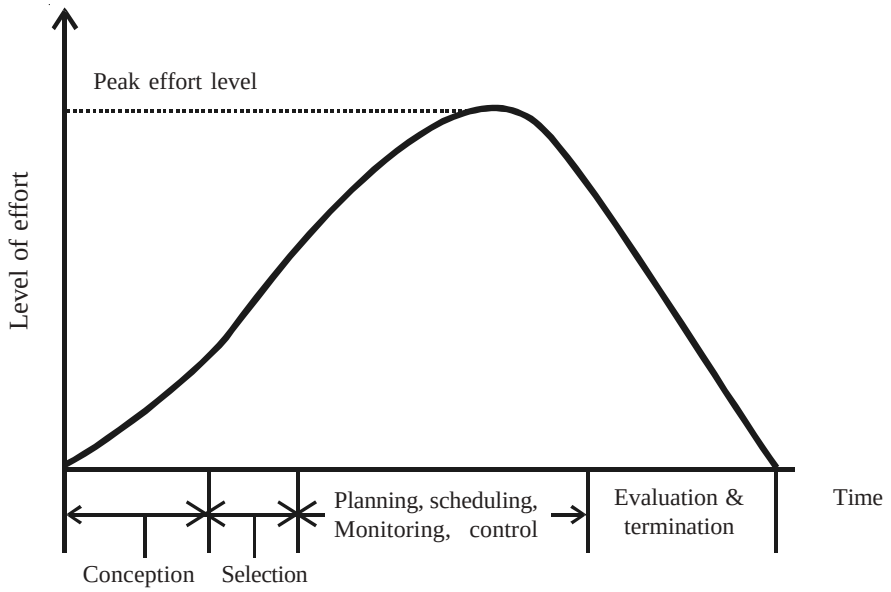

Figure 4.2: Time distribution of project effort

When the major "how" problems are solved, project workers sometimes get preoccupied with improving performance, often beyond the levels required by the original specifications. This search for additional performance delays the schedule and pushes up the costs.

The middle stages of the life cycle are typified by a growing concern with cost control. During the latter stages of the life cycle, focus of attention is on time. With projects nearing completion, there tends to be more flexibility in cost and efforts are directed towards bringing things into conformity with the approved schedule-as much as possible, even if it means cost penalties.

It would be a great source of comfort if one could predict with certainty, at the start of a project, how the performance time, and cost goals would be met. In

a few cases, for example routine construction projects, we can generate reasonably accurate predictions, but often we cannot. There may be considerable uncertainty about our ability to meet project goals. The crosshatched portion of Figure 4.2 illustrates this uncertainty.

Activity 1

a) Identify activities that constitute a project

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b) List out five national projects

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c) List out five international projects

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d) List out four stages of a national project.

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e) Identify four major elements that constitute an international project plan.

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4.5 PROJECT MANAGEMENT DEFINED

Project management is the process of identifying project opportunities, formulating profitable project profiles, procuring funds for project implementation, scheduling of project activities in such a way as to complete the project within the minimum possible time/cost, and monitoring of the project after its implementation.

Defining what is to be done and ensuring that it is done and performed as desired within time and cost budgets fixed for it through a modular work approach, using organizational and extra-organizational resources is what project management has to achieve.

4.6 PLANNING PROJECT WORK

Project planning as represents a set of six planning sequences. First comes preliminary coordination where the various parties involved in the project get together and make preliminary decisions about what will be achieved (project objectives) and by whom. These preliminary plans serve as the basis for a detailed description of the various tasks that must be undertaken and accomplished in order to acieve the objectives of the project. In addition, the very act of engaging in the preliminary planning process increases the members' commitment to the project.

These work plans are used for the third and fourth sequences, deriving the project budget and schedule. Both the budget and the schedule directly reflect the detail (or lack of it) in the project work plan, the detail description of projects tasks. The fifth planning sequence is a precise-description of all project status reports, when they are to be produced, what they must contain, and to whom they will be sent. Finally, plans must be developed that deal with project termination, explaining in advance how the project pieces will be redistributed once its purpose has been completed.

But before we begin, we assume that the purpose of planning is to facilitate accomplishment of its objectives. The world is full of plans that never become deeds. The planning techniques covered here are intended to smooth the path from idea to accomplishment. It is a complicated process to manage a project, and plans act as a map of this process. The map must have sufficient detail to determine what must be done next but be simple enough that workers are not lost in a welter of minutiae.

4.6.1 Initial Project Coordination

It is a crucial that the project's objectives be clearly tied to the overall vision and mission of the firm. Senior management should define the firm's intent in undertaking the project, outline the scope of the project, and describe the project's desired end results. Without a clear beginning, project planning can easily go astray. It is also vital that a senior manager should call an initial coordinating meeting and be present as a visible symbol of top management's commitment to the project.

At the meeting, the project is discussed in sufficient detail the potential contributors develop a general understanding of what is needed. If the project is one of many similar projects, the meeting will be quite short and routine, a sort of "touching base" with other interested units. If the project is unqiue in most of its aspects, extensive discussion may be required.

Whatever be the process, the outcome must be that : (1) technical objectives are established (though perhaps not "cast in concrete"), (2) basic areas of performance responsibility are accepted by the participants, and (3) some tentative schedules and budgets are spelt out. Each individual/unit accepting responsibility for a portion of the project should agree to deliver; by the next project meeting a preliminary but detailed, plan about how that responsibility will be accomplished. Such plans should contain descriptions of the required tasks, budgets, and schedules.

These plans are then reviewed by the group and combined into a composite project plan. The composite plan, still not completely firm, is approved by each participating group, by the project manager, and then by senior organizational management. Each subsequent approval "hardens" the plan somewhat, and when senior management has endorsed it, any further changes must be made

by processing a formal change order. However, if the project is not large or complex, informal written memoranda can substitute for the change order. The main point is that no significant changes in the project are made, without written notice, following top management's approval. The definition of "significant" depends on the specific situation and the people involved.

Project Plan Elements

Given the project plan, approvals really amount to a series of authorizations. The project manager is authorized to direct activities, spend monies (usually within preset limits), request resources and personnel, and start the project on its way to completion. Senior management's approval not only signals its willingness to fund and support the project, it also notifies sub-units in the organization that they may commit resources to the project.

The process of developing the project plan varies from organization to organization, but any project plan must contain the following elements:

Overview: This is a short summary of the objectives and scope of the project. It is directed to top management and contains a statement of the goals of the project, a brief explanation of their relationship to the firm's objectives, a description of the managerial structure that will be used for the project, and a list of the major milestones in the project schedule.

Objectives: This contains a more detailed statement of the general goals noted in the overview section. The statement should include profit and competitive aims as well as technical goals.

General Approach: This section describes both the managerial and the technical approaches to the work. The technical discussion describes the relationship of the project to available technologies. For example, it might note that this project is an extension of work done by the company for an earlier project. The subsection on the managerial approach takes note of any deviation from routine procedure, for instance, the use of subcontactors for some parts of the work.

Contractual Aspects: This critical section of the plan includes a complete list and description of all reporting requirements, customer-supplied resources, liaison arrangements, advisory committees project review and cancellation procedures, proprietary requirements, any specific management agreements (eg., use of subcontractors), as well as the technical deliverables and their specifications and delivery schedule. Completeness is a necessity in this section. If in doubt about whether an item should be included or not, the wise planner will include it.

Schedules : This section outlines the various schedules and lists all milestone events. The estimated time for each task should be obtained from those who will do the work. The project master schedule is constructed from these inputs. The responsible person or department head should sign off on the final, agreed-on schedule.

Resources: There are two primary aspects to this section. The first is the budget. Both capital and expense requirements are detailed by task, which makes this a project budget. One-time costs are separated from recurring project costs. Second, cost monitoring and control procedures should be described. In addition to the usual routine cost elements, the monitoring and control procedures must be designed to cover special resource requirements for the project, such as special machines, test equipment, laboratory usage or construction, logistics, field facilities and special materials.

Personnel : This section lists the expected personnel requirements of the project. Special skills, types of training needed, possible recruiting problems, legal or policy restrictions on work-force composition, and any other special requirements, such as security clearances, should be noted here. It is helpful to index personnel needed for the project schedule. This makes clear when the various types of contributors are needed and in what numbers. These manpower projections are important element of the budget, so the personnel, schedule, and resources sections can be cross-checked with one another to ensure consistency.

Evaluation Methods : Every project should be evaluated against standards and by methods established at the project's inception. This section contains a brief description of the procedure to be followed in monitoring, collecting, storing, and evaluating the history of the project.

Potential Problems: Sometimes it is difficult to convince planners to make a serious attempt to anticipate potential difficulties. One or more such possible disasters as subcontractor's default, technical failure, strikes, bad weather, sudden required breakthroughs, critical sequences of tasks, tight deadlines, resource limitations, complex coordination requirements, insufficient authority in some areas, and new, complex, or unfamiliar tasks are certain to occur. The only uncertainties are which ones will occur and when. In fact, the timing of these disasters is not random. There are times, conditions, and events in the life of every project when progress depends on subcontractors, or the weather, or coordination, or resource availability, and plans to deal with unfavourable contingencies should be developed early in the project's life cycle. Some Project managers disdain this section of the plan on the grounds that crises can not be predicted. Further, they claim to be very effective "fire fighters." It is quite possible that when one finds such a Project manager, one has discovered an "arsonist." No amount of current planning can solve the current crisis, but pre planning may avert some.

These are the elements that constitute the project plan and are the basis for a more detailed planning of the budgets, schedules, work plan, and general management of the project. Once this basic plan is fully developed and approved, it is disseminated to all interested parties.

4.6.2 Systems Integration

System integration (sometimes called systems engineering) plays a crucial role in the performance aspect of the project. We are using this phrase to include any technical specialist in the science or art of the project who is capable of performing the role of integrating the technical disciplines to achieve the customer's objectives. As such, systems integration is concerned with three major objectives.

- **Performance:** Performance is what a system does. It includes system design, reliability, maintainability, and reparability. Obviously, these are not separate, independent elements of the system, but are highly interrelated qualities. Any of these system performance characteristics is subject to over-design as well as undersign but must fall within the design parameters established by the client. If the client approves, we may give the client more than the specifications require simply because we have already designed to some capability, and giving the client an overdesigned system is faster and less expensive than delivering precisely to specification. At times, the aesthetic qualities of a system may be specified, typically through a requirement that the appearance of the system must be acceptable to the client.

- **Effectiveness:** The objective is to design the individual components of a system to achieve the desired performance in a optimal manner. This is accomplished throught the following guideline: Require no component performance specification unless necessary to meet one or more systems requirements. Every component requirement should be traceable to one or more systems requirements. Design components to optimize system performance, not the performance of a subsystem.
- **Cost:** Systems integration considers cost to be a design parameter, and costs can be accumulated in several areas. Added design cost may lead to decreased component cost, leaving performance and effectiveness otherwise unchanged. Added design cost may yield decreased production cost, and production cost may be trade-off against unit cost for materials. Value engineering examines all these cost trade-offs and is an important aspect of systems integration. It can be used in any project where the relevant cost trade-offs can be estimated. It is simply the consistent and thorough use of cost/effectiveness analysis. For an application of value engineering techniques applied to disease control projects.

Systems integrations plays a major role in the success or failure of any project. If a risky approach is taken by system integration, it may delay the project. If the approach is too conservative, we forego opportunities for enhanced project capabilities or advantageous project economics. A good design will take all these trade-offs into account in the initial stages of the technical approach. And it will avoid locking the project into a rigid solution with little flexibility or adaptability in case problems occur later on or changes in the environment demand changes in project performance or effectiveness.

4.6.3 Sorting Out the Project

In order to ensure a successful completion of a Project we need to know exactly what is to be done, by whom, and when. All activities required to complete the project must be precisely delineated and coordinated. The necessary resources must be available when and where they are needed, and in the correct amounts. Some activities must be done sequentially, but some may be done simultaneously. If a large project is to come in on time and within cost, a great many things must happen when and how they are supposed to happen. In this section, we propose a simple method to assist in sorting out and planning all this detail.

To accomplish any specified project, there are several major activities that must be completed. First, list them in the general order in which they would normally occur. A reasonable number of major activities might be anywhere between two and twenty. Break each of these major activities into two to twenty subtasks. There is nothing sacred about the “two to twenty” limits. Two is the minimum possible breakdown and twenty is about the largest number of interelated items that can be comfortably sorted and scheduled at a given level of task aggregation. Second, preparing a network from this information, is much more difficult if the number of activities is significantly greater than twenty.

Sometimes a problem arises because some managers tend to think of outcomes (events) when planning and other think of specific tasks (activities). Many mix the two. The problem is to develop a list of both activities and outcomes that represents an exhaustive, non redundant set of results to be accomplished (outcomes) and the work to be done (activities) in order to complete the project.

The procedure proposed here is a heirarchical planning system. First, the goals must be specified. This will aid the planner in identifying the set of required activities for the goals to be met, the project Action Plan. Each activity has an

outcome (event) associated with it, and these activities and events can be decomposed into sub-activities and sub-events, which may, in turn, be subdivided again. The Project Plan is the set of these Action Plans. The advantage of the Project Plan is that it contains all planning information in one document.

4.6.4 The Work Breakdown Structure and Linear Responsibility Charts

The Work Breakdown Structure (WBS) used in project management is a type of Gozinto chart and is constructed directly from the project's Action Plans. The WBS may also be perceived as an organization chart with tasks substituted for people as shown in Figure 4.3. It pictures a project subdivided into heirarchical units of tasks, work packages, and work units. The end results is a collection of work units each of which is relatively short in time span. Each has definite beginning and ending points along with specific criteria for evaluating performance. Each part of the project down to the smallest subtask elements is budgetable in terms of money, man hours, and other requisite resources. Each is a single, meaningful job for which individual responsibility can be assigned. Each can be scheduled as one of the many jobs that the organization must undertake and complete.

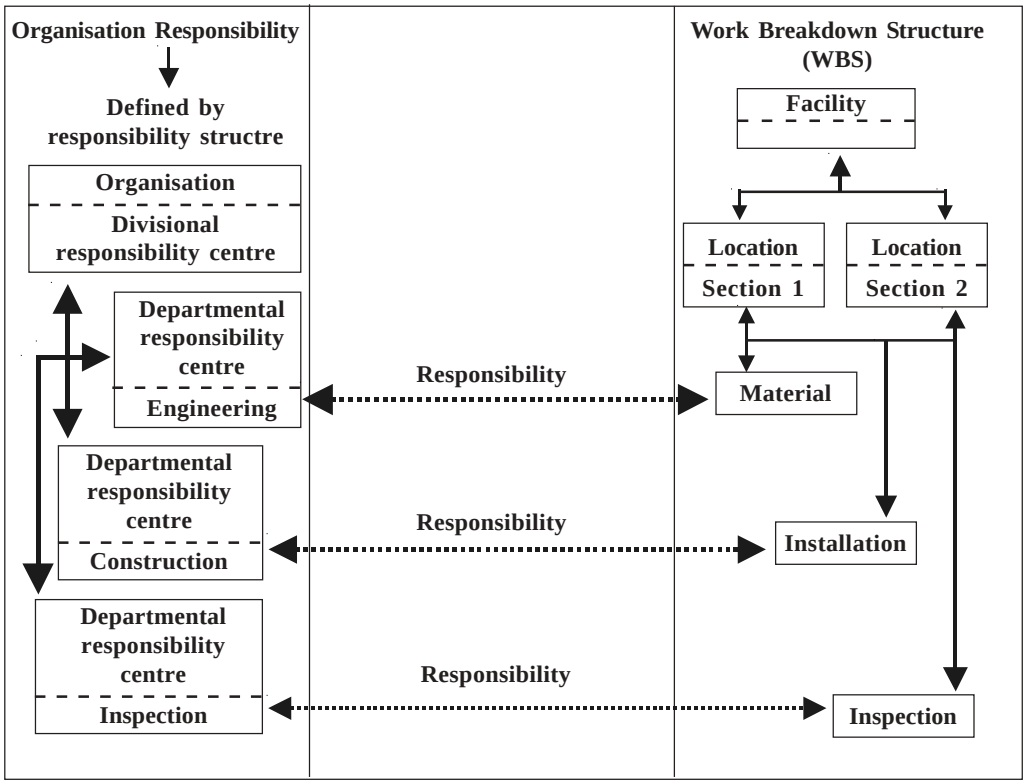

Figure 4.3: Responsibility/WBS relationship

Source: *Lavold, G.D., "Developing and Using the Work Breakdown Structure", in Cleland D.I., and W.R. King. Project Management Handbook, Van Nostrand Reinhold, 1983.*

In constructing the WBS, it is wise to contact the managers and workers who will be directly responsible for each of the work packages. These people can develop a hierarchical plan for the package delegated to them.

The WBS can be used to illustrate how each piece of the project is tied to the whole in terms of performance, responsibility, budgeting, and scheduling. The following general steps explain the procedure for designing and using the WBS

as it would be used on a large project. For small or moderate-size projects, some of the steps might be skipped, combined, or handled less formally than our explanation indicates, particularly if the project is of a type familiar to the organization.

1) Using information obtained from the people who will perform the work, break project tasks down into successively finer levels of detail. Continue the decomposition of work until all meaningful tasks have been identified and each task can be individually planned, scheduled, budgeted, monitored, and controlled.

2) For each such work element:

   Make up a work statement that includes the necessary inputs, the specification reference, particular contractual stipulations, and specific end results to be achieved. List any vendors, contract, and subcontractors who are or may be involved. Identify detailed end item specifications for each work element regardless of the nature of the end item, whether hardware, software, test results, reports, etc.

   Establish cost account numbers.

   Identify the resource needs, such as manpower, equipment facilities, support, funds, and materials. Cost estimators can assist the Project Manager in constructing a task budget composed of costs for materials, manufacturing operations, freight, engineering, contingency reserves, and other appropriate charges.

   List the personnel and organizations responsible for each task. It is helpful to construct a linear responsibility chart (sometimes called a responsibility matrix) to show who is responsible for what. This chart also shows critical interfaces between units that may require special managerial coordination. With it, the Project Manager can keep track of who must approve what and who must report to whom.

3) The WBS, budget, and time estimates are reviewed with the people or organizations who have responsibility for doing or supporting the work. The purpose of this review is to verify the WBS's accuracy, budget, schedule, and to check interdependency of tasks, resources, and personnel. The WBS may be revised as necessary, but the planner must be sure to check significant revisions with all individuals who have previously made inputs. When agreement is reached, individuals should sign off on their individual elements of the project plan.

4) Resource requirements, time schedules, and subtask relationships are now integrated to form the next higher level of the WBS; and so it continues at each succeeding level of the WBS hierarchy. Thus, each succeeding level of the WBS will contain the same kinds of information regarding resources, budgets, schedules, and responsibilities as the levels below it. The only difference is that the information is aggregated to one higher level.

5) At the uppermost level of the WBS, we have a summary of the project budget. For the purpose of pricing a proposal, or determining profit and loss, the total project budget should consist of four elements: direct budgets from each task as described above; an indirect cost budget for the project, which includes general and administrative overhead costs (G&A), marketing costs, potential penalty charges and other expenses not attributable to particular tasks; a project "contigency" reserve for unexpected emergencies; and any residual, which includes the profit derived from the project, which may, on occasion, be intentionally negative.

6) Similarly, schedule information and milestone events can be aggregated into a project master schedule. The master schedule integrates the many different schedules relevant to the various parts of the project. It is

comprehensive and must include contractual commitments, key interfaces and sequencing, milestone events, and progress reports. In addition, a time contingency reserve for unforeseeable delays should be included.

This series of steps complete the use of the WBS as a project planning document. The WBS is also a key document for implementing, monitoring, and controlling the project. The remaining steps concern its use for these purposes.

7) One can now compare required task performance and outputs specified in the WBS with those specified in the basic project plan in order to identify potential misunderstandings, problem, and schedule slippages, and then design corrective actions.

8) As the project is carried out, step by step, the Project Manager can continually examine actual resource use, by work element, work package, task, and so on up to the full project level. By comparing actual against planned resource usage to a given point in time, the Project Manager can identify problems, harden the estimates of final cost, and make sure that relevant corrective actions have been designed and are ready to implement if needed. It is necessary to examine resource usage in relation to results achieved because, while the project may be over budget, the results may be further along than expected. Similarly, the expenses may be exactly as planned, or even lower, but actual progress may be much less than planned.

9) Finally, the project schedule must be subjected to the same comparisons as the project budget. Actual progress is compared to scheduled progress, by work element, package, task, and complete project, to identify problems and take corrective action. Additional resources may be brought to those tasks behind schedule so as to expedite them. These added funds may come out of the budget reserve or from other tasks that are ahead of schedule.

4.7 SUMMARY

For any developing economy new investments in greenfield projects, expansion of existing projects, diversification etc. is an integral part of the strategy to move towards higher rate of growth. All this requires resources and strategy to allocate resources as resources are always in short supply. Apart from allocating resources the various resources has to be coordinated. All this requires a specialized technique known as project management & planning. In this unit we have discussed about the unique features of the project, the project life cycle which represents the relationship between time and project completion and also depicts the rate of progress with respect to time. In the next section we have discussed about the various elements which has to be kept in consideration while planning the project work we had talked about work Breakdown Structure which shows how each piece of the project is tied to the whole in terms of performance, responsibility, budgeting and scheduling.

4.8 SELF ASSESSMENT QUESTIONS

1) What are the six component planning sequences of project planning?

2) Any successful project plan must contain nine key elements. List these items and briefly describe the composition of each.

3) What are the basic guidelines for systems design that assure that individual components of the system are designed in an optimal manner?

4) What are the general steps for managing each “work package” within a specific project?

5) What percentage of the total project effort do you think should be devoted to planning? Why?

6) Why do you suppose that the coordination of the various elements of the project is considered the most difficult aspect of project implementation?

7) What kinds of problem areas might be included in the project plan?

8) What is the role of systems integration in project management? What are the three major objectives of systems integration?

9) In what ways may the WBS be used as a key document to monitor and control a project?

10) Describe the process of subdivision of activities and events which compose the "tree" diagram known as the Work Breakdown Structure or Gozinto chart. Why is the input of responsible managers and workers so important an aspect of this process?

4.9 FURTHER READINGS

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