Chapter 10. Project Management of I&C Projects

10.1. Fundamentals of project management

Operations and projects share a number of characteristics in that they are:

- Planned, executed, and controlled
- Constrained by resource limitations
- Performed by people

Projects are, however, different from operations (such as maintenance or repair work) in that they are temporary endeavors undertaken to create a unique product or service.

The primary objectives of a project are commonly defined by reference to function, time, and cost.

10.1.1. Project management

Project management is the application of specific knowledge, skills, tools, and techniques to plan, organise, initiate, and control the implementation of the project, in order to achieve the desired outcome(s) safely.

Note that 'Project Management' is also used as a term to describe an organisational approach known as 'Management by Projects', in which elements of ongoing operations are treated as projects, and project management techniques are applied to these elements.

10.1.2. Project life cycle

Projects proceed through a sequence of phases from concept to completion. Collectively, the separate phases comprise the project 'life cycle'.

There are only a limited number of generic lifecycles. The generic types are usually considered to include capital works, pharmaceutical, petrochemical, defence procurement, research and development. Consequently the initial starting point for managing the project is to define the type, and select an appropriate life cycle model as the planning framework.

10.1.3. Project organization

Where projects are set up within existing organizations, the structure and culture of the parent organization has great influence on the project, and will be a deciding factor in whether or not there is a successful outcome. The organization of the project team directly influences the probability of achieving a successful outcome.

The influence of the organization structure on various project parameters is illustrated in Figure 10.1

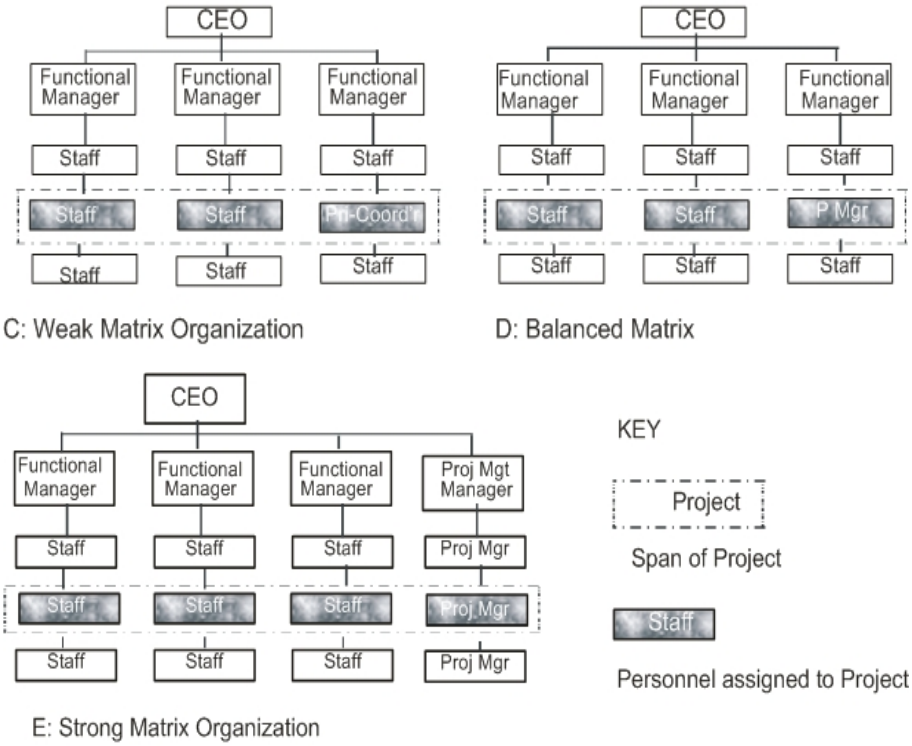

Figure 10.1
Project structures within organizations

The organization of the project team is characterized by:

- The principal or project sponsor.
- The Project Control Group (PCG).
- The project manager. In a 'perfect world' the responsibilities, roles and authority of this person would be defined and documented.
- A project control officer or group, if this function is not undertaken by the project manager.
- The rest of the project team, which will vary in composition according to the project type, as well as specific project variables.

10.1.4. Project planning

The project planning phase is critical to the effective implementation and control of the project and the basis for project success is established during this phase. The primary output from this phase is the Project Quality Plan (PQP). The basic element required to properly define the PQP is the Work Breakdown Structure or WBS.

The PQP comprises the following:

- The PQP sign-off
- The statement of project objectives
- The project charter
- The project plan
- Project control procedures

10.2. Time management

Time management of a project consists of:

- Planning the project activities to a time scale (i.e. the project schedule)
- Monitoring performance of the implementation phase
- Comparing achieved performance with the project schedule
- Taking corrective action to ensure planned objectives are most likely to be met.

10.2.1. Project planning

The principal aim of project management is to effectively utilize the available resources in order to achieve the planned objective(s).

The most commonly used methods in the field of project management are known collectively as Project Network Techniques. These comprise:

- The 'Critical Path' method (also known as the Activity on Arrow or AoA method)
- The 'Precedence' method (also known as the Activity on Node or AoN method)

Precedence network analyses are normally presented graphically, either as the network diagram itself, or as a time-scaled bar chart known as a Gantt chart. Critical path networks can be presented as time-scaled arrow diagrams, or as Gantt charts.

Project analysis by either method involves the same four steps:

- Defining the activities, for the initial project plan this may involve the breakdown of work packages used as the basic elements for the other components of the PQP.
- Preparation of the logic sequence to determine the relationships between the activities.
- Applying activity (time and resource) data for each activity.
- Analysis of the network.

10.3. Cost Management

Effective cost management is a key element of successful project management. The critical aspects of the cost management process have to be reviewed, that must be properly addressed to ensure effective financial control.

Cost management includes the processes required to ensure that the project/contract is completed within the approved budget. These processes comprise:

- Cost estimating
- Budgeting
- Financial control
- Change control
- Cost monitoring
- Value management

Cost estimating: Estimating costs is of fundamental importance to every project. Estimates are prepared to meet two different objectives:

- As the basis for determining the economic feasibility of a project
- As the basis for cost management of the project.

Budgeting: Budgeting involves allocating the cost estimates against the project/contract schedule. The budgeting process should establish a cost baseline that provides:

- The basis against which project performance may be measured
- A forecast payment schedule to allow for funds management by the principal

Financial control: The definition of financial controls should extend to:

- Controls over the commitment of funds, i.e. financial authority
- Controls over the approval of expenditure, i.e. authorization of payments

Change control: Effective change control is a vital element of project cost control. This process is often referred to as scope control.

- Following approval of the project budget, there will be unavoidable changes to the project arising from discretionary and non-discretionary sources.

Cost reporting: The basic objective of the financial report must be to provide an accurate status report of forecast financial cost versus approved budget. To meet this objective, the financial report needs to include the following information:

- Initial budget
- Approved budget variances to date
- Current budget
- Current forecast final cost

Value management: The objective of the Value Management (VM) process is to achieve the lowest possible cost without prejudicing required functionality or necessary quality; i.e. to improve the value/cost relationship.

10.4. Integrated cost and time management

The objective of integrated cost and time management is to demonstrate the power of applying Earned Value Analysis (EVA) to measuring and predicting project performance and to develop skill in the application of the Performance Measurement System.

Earned value analysis: Earned Value Analysis (EVA) is the analytical part of what is known as Earned Value Management (EVM), so the two names are often used interchangeably.

This provides a management tool that determines the extent of cost variances that may be separately attributed to over/under expenditure and to scheduled deviations.

A significant benefit of the EVM approach is that most of the data can be presented graphically, in one macroscopic view of the project progress.

10.5. Management of project team

Projects exist to create a unique product or service within a limited time frame. Projects are performed by people. If there is more than one person working in a project then it is called a team. A team is a mixture of a wide assortment of personalities, skills, needs, and issues.

10.5.1. Creating a team culture

Cultures within the project team are a reflection of the project manager's preferences and style.

Project managers need to specifically address the following:

- Clarifying roles, responsibilities and levels of authority for all team members
- Setting up effective channels of communication with all team members
- Setting realistic performance expectations for each team member
- Delegating effectively (instead of over-supervising)
- Publicly rewarding good performance
- Acknowledging legitimate concerns and conflicts within the team

At each stage the project manager can communicate values that move the team to the next stage. The stages in team development are referred to as the processes of ‘forming’, ‘storming’, ‘norming’ and ‘performing’.

10.5.2. Team motivation

There are certain issues that spur on individuals within the team to even greater achievements, and other issues that stifle performance.

The major motivators are (in descending order of importance):

- Achievement
- Recognition
- The work itself

- Responsibility
- Advancement
- Personal growth

10.6. Risk Management

The objective of Risk management is to set out a basis for risk management that will provide sufficient understanding of the process for implementing effective risk management for a specific project.

Definition of 'risk': Risk is the exposure to a process or event that prejudices the successful achievement of the project outcome, by adversely impacting on cost, time, or functional objectives.

The elements of risk are:

- The likelihood of the event arising; and
- The consequences if it does arise

10.6.1. Elements of Risk management

The main elements of the risk management process are:

- Establishing the context
- Risk identification
- Risk analysis
- Risk assessment
- Risk treatment
- Monitoring and reviewing

Establishing the context: The outputs from this step are:

- Definition of the elements within the project to define a structure for the identification and analysis of risks; and
- Definition of risk assessment criteria directly related to the policies, objectives and interests of stakeholders

This process reviews the strategic, organizational and project contexts.

Risk identification: The purpose of this step is to identify all the risks, including those not under the control of the organization, which may impact on the framework defined above.

A systematic process is essential because a risk not identified during this step is removed from further consideration.

Risk analysis: The objectives of risk analysis are to:

- Assign a level of risk to each identified event
- Provide data to assist the assessment and treatment processes
- Separate minor, acceptable risks from others requiring further consideration

Risk is analyzed by consideration of the likelihood and consequence of events occurring within the context of existing controls i.e. management procedures, technical systems and risk management procedures.

Risk assessment: Risk assessment is the process of comparing the levels of risks determined from the analysis process against the acceptance criteria previously established.

The output from the risk assessment is a prioritized list of risks requiring further action.

Risk treatment: Risk treatment involves identifying the range of options available for treating risks identified as requiring action in the previous stage, evaluating those options in respect of each risk, and developing and implementing risk treatment plans.

Note that some risk response activities may have been undertaken during the qualitative analysis step, if the urgency of developing a response to specific risks warranted it.

Monitoring and review: Monitoring and review of all elements of the risk management programme is essential.

The specific risks themselves, as well as the effectiveness of the control measures, need to be monitored. Few risks remain static and factors impacting on the likelihood or consequences may change.

Changing circumstances may alter earlier priorities, and factors impacting on the cost/benefit of management strategies may vary.

10.7. Contract law

The selected issues of contract law are to be reviewed, where a basic understanding of the applicable law is likely to be of direct assistance to personnel involved in the administration of procurement contracts. The issues addressed include:

- The basis of Commonwealth law
- The essential elements of contracts
- Procurement strategies
- Tendering
- Vitiating factors, i.e. those factors that reduce or remove the legal force of the contract
- Termination of contracts
- Extensions of time
- Remedies available for breach of a contract
- Penalties and bonuses

10.7.1. The Commonwealth legal system

In the Commonwealth legal system the Legislature makes the laws, the Executive administers the laws and the Judiciary decides in the case of disputes or transgressions of the laws.

The only way in which rules can be enacted so as to apply generally is by Act of Parliament. Some of Parliament's legislative functions are delegated to subordinate bodies who, within a limited field, are allowed to enact rules.

10.7.2. Elements of contracts

- The contract may be oral, or written, or implied by the conduct of the parties.
- Any simple contract put into writing with adequate particulars becomes a formal contract. It is then a formal simple contract.
- When made by a company it is generally under seal. The period of limitation is 12 years for breach of contracts made under seal. In respect of building construction contracts, S91 of the Building Act 1991 sets the period of limitation at 10 years.
- A contract made by deed must be under seal. If made by deed, no consideration is required, for example, a will or arbitration agreement.

The essential requirements for a contract to be legally enforceable are:

- The intention to create legal relations
- Agreement (offer and acceptance)
- Consideration
- Definite terms
- Legality
- Capacity of the parties

10.7.3. Procurement strategy issues

Consideration of the appropriate strategy should include the following factors:

- Risk preferences of the Principal
- The requirement to demonstrate a competitive process
- The need and/or ability to properly define scope of work prior to commencement
- The need or ability to exercise control over the operations of the Contractor
- The need to achieve early completion

There are a number of separate aspects to be considered when determining construction procurement strategy. These include:

- Tendering strategies
- Pricing strategies
- Timing strategies
- Contract types
- Delivery strategies

10.7.4. Contract types

Construction contracts may be one of the following three basic types, or a combination thereof. Contracts of each type may or may not be subject to cost escalation: if not, they are described as 'fixed price' contracts.

Lump sum: Irrespective of the inputs actually necessary to properly complete the works defined in the contract document, the Contractor is entitled to be paid only the contract sum.

10.7.5. Delivery strategies

For service delivery contracts the principal delivery strategies are:

- Defining service requirements based on inputs to be provided.
- Defining service requirements based on performance and condition criteria for serviced units.

10.7.6. Tendering

The law relating to tendering practice is in a process of change as the result of recent case law developments, primarily in Canada. It may be assumed that in due course these cases will be followed throughout the Commonwealth. Previously it was generally regarded, at least by the practitioners, that no contractual obligations arise prior to acceptance of a tender.

This approach does protect a Contractor from the risk of sub-Contractors revoking their tender.

10.7.7. Vitiating factors

Contracts can be:

- Void: The contract is defective in law, a nullity; e.g. an immoral contract
- Avoidable: The contract is binding, but one party has the right, at his option, to set it aside

The following factors make contracts void or avoidable:

- Mistakes
- Misrepresentation
- Duress and undue influence

10.7.8. Termination of contracts

The contract is discharged when the obligation ceases to be binding on the promisor, who is then under no obligation to perform. This arises from:

- Performance
- Agreement
- Passage of time
- Frustration
- Repudiation
- Determination
- Operation of law

10.7.9. Time for completion and extensions of time

- Time for completion
- Provisions to extend the time for completion
- Determination of extensions of time
- Notification of the time extension
- Acceleration
- Payment arising from an extension of time

10.7.10. Remedies for breach of contract

Damages for breach of contract are governed by two considerations, namely the remoteness and the measure of damages.

The contracting parties may agree as a term of the contract the amount to be paid in the event of a specific breach. This sum is either a liquidated damage or a penalty.

The right to an action for damages may be released by:

- Release under seal
- Release by accord and satisfaction
- Fluxion of time, i.e. the right to claim damages is extinguished by the passage of time.

10.7.11. Penalties and bonuses

A penalty is a sum in the nature of a threat to secure performance. Courts will not enforce penalties.

Building contracts may provide for a bonus to be paid, for example for early completion, or for completion below a defined price.