UNIT 4 PROJECT MANAGEMENT

Structure

4.0 OBJECTIVES

After reading this unit, we shall be able to:

- know the definition of project management and related activities;
- understand the different phases and framework of project management;
- describe the relationship between project management and line management;
- explain the role of strategy in project management;
- know the importance of time planning and role of teams in project management; and
- understand the different control systems, constraints and corrective actions required for effective project management.

4.1 INTRODUCTION

A project can be defined by ISO 10006:2003 as "unique process consisting of a set of coordinated and controlled activities with start and finish dates, undertaken to achieve an objective conforming to specific requirements including constraints of time, cost and resources". It is a 'non-repetitive activity'. This needs to be augmented by other characteristics:

- It is goal oriented – it is being pursued with a particular end or goal in mind;

- It has a particular set of constraints – usually centred around time and resources;
- The output of the project is measurable; and
- Something has been changed through the project being carried out.

Project management includes planning, organising, directing and controlling activities in addition to motivating what is usually the most expensive resource on the project – the people. Planning involves deciding what has to be done, when and by whom. The resources then need to be organised through activities such as procurement and recruitment. Directing their activities towards a coherent objective is a major management role. The activities also need controlling to ensure that they fit within the limits (e.g. financial) set for them.

'PRINCE' (Projects in Controlled Environments) – the standard project management methodology for government information technology departments – defines a project in terms of its products. These are categorised as:

- management - the planning, documentation and control actions of management;
- technical – the planning, documentation and review of technical aspects of the project; and
- quality – the planning, documentation and review of the quality control of the project system.

'PRINCE' is a project management shell or structure within which plans can be formulated and actions controlled throughout the project life-cycle. Its major benefit is providing a degree of methodology standardisation between projects. This allows managers to concentrate on details of their specific project, confident in a recognised and proven method.

Having defined a project and outlined the role of management in this environment, we can now examine more closely what a project involves. This will be done through breaking the project down into three phases.

4.2 THE THREE PHASES OF PROJECT MANAGEMENT

One of the leaders of the change in management thinking to concentrate on quality rather than quantity of output was Dr. W. Edwards Deming. His original work was centred on the operational aspects of quality management – in particular the use of statistical data in controlling processes. This work was adopted with far greater vigour in Japan than in his native America, but latterly has been given more prominence in Western management study. He is famous for producing his 14 management points. The fifth of these points is:

'Improve constantly and forever every activity in the company, to improve quality and productivity and thus constantly decrease costs'.

The means by which this constant improvement is achieved is by the approach shown in Fig. 4.1. The *planning* stage involves the formulation and revision of statements of intended activity, whether formalised or otherwise. The doing is the time when the project is carried out (the direct value-adding phase). The *check/study* phase involves a critical appraisal of both the project output (was a good result achieved?) as well as the process (was it carried out as well as it could have been?) the *act* stage is that

phase when the project process is considered to see how the lessons learned and gleaned from the review could be channelled back to the people involved in the process.

Applied to the project environment, the three Ds of project management describe the three phases. These are:

- *Design it* – identify the need that the project will serve, construct models to show how the needs will be developed, evaluate these to determine the optimum process for the task and minimise risk;
- *Do it* – carry out the project in line with the models or plans generated above;
- *Develop it* – improve the models and processes in the light of the experience gained from the project, incorporating the check/study and act parts of the Deming cycle.

There is no 'most important phase' – they represent a chain of activities. Like a chain, the project performance will only be as good as the weakest part of the process. The last phase has a significant input to the performance of subsequent projects, in addition to elements of it determining the performance of the current project.

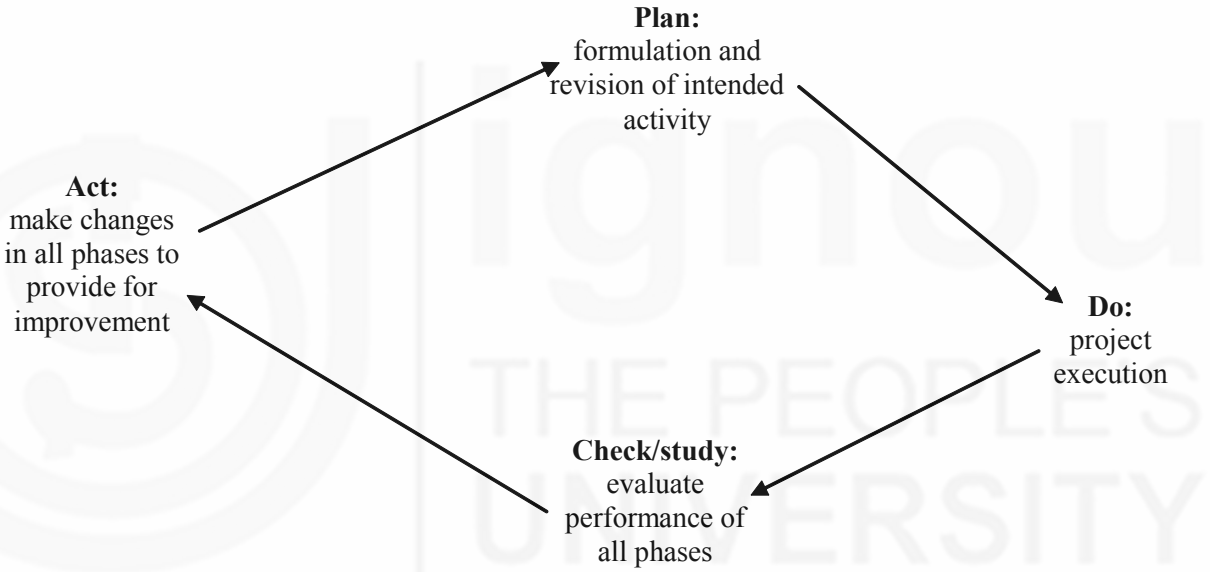

Fig. 4.1: Deming cycle for project management (PDCA)

The three phases provide the three sections of this text. Their application is summarised in Table 4.1.

Table 4.1: The Three Phases of Project Management

Phase	Key Issues	Fundamental Questions
Design it	Project and organisational strategy, goal definition, modelling and planning, estimating, resource analysis, conflict resolution and justification.	What is to be done? Why is it to be done? How will it be done? Who will be involved in each part? When can it start and finish?
Do it	Organisation, control, leadership, decision-making and problem-solving.	How should the project be managed on a day-to-day basis?
Develop it	Assessment of process and outcomes of the project, evaluation, changes for the future.	How can the 'management process' be continually improved?

There are a number of tasks and issue to be addressed in each phase. This provides a degree of complexity for the project manager and is one reason that there are few truly excellent examples of project management available. Taking the analogy of the project as a *chain*, it is important that there is general competence across the phases. This is preferable to there being excellence in one area, with other areas falling down.

The generic life-cycle for a project involves consideration of how the level of activity varies with time. This is illustrated in Fig. 4.2 and shows how the level of activity is relatively low during the design phase, increases through the doing phase, and decreases through the development phase.

This pattern is reflected in the graph of cumulative expenditure against time (Fig. 4.3). Outgoing are generally low in the early stages, but grow rapidly during the execution phase. The graph also demonstrates why the 'develop it phase' is so vital – by the time the majority of the doing phase is completed, the probability is that in excess of 98% of the total project expenditure will have been incurred. The last phase is the time when the project team themselves can benefit from the process and ensure that lessons (good and bad) are applied in the future.

The life-cycle may be further broken down as shown in Table. 4.2

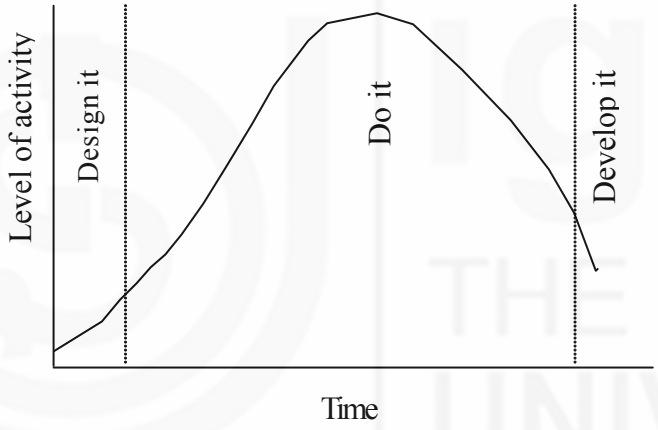

Fig. 4.2: Graph showing how level of activity varies with time

Table 4.2: Development of the project life-cycle

Stage in project life-cycle	Activity	Description
Design it	Conceptualisation	Generate explicit statement of needs.
	Analysis	Identify what has to be provided to meet those needs.
	Proposal	Show how those needs will be met through the project activities.
	Justification	Prepare and evaluate financial costs and benefits from the project.
	Agreement	Point at which go-ahead is agreed by project sponsor.
Do it	Start-up	Gathering of resources, assemble project teams.
	Execution	Carry out defined activities.

	Completion	Time/money constraint reached or activity series completed.
	Handover	Output of project passes to client/user.
Develop it	Review	Identify the outcomes for all share-holders.
	Feedback	Put in place improvements to procedures, fill gaps in knowledge, document lessons for the future.

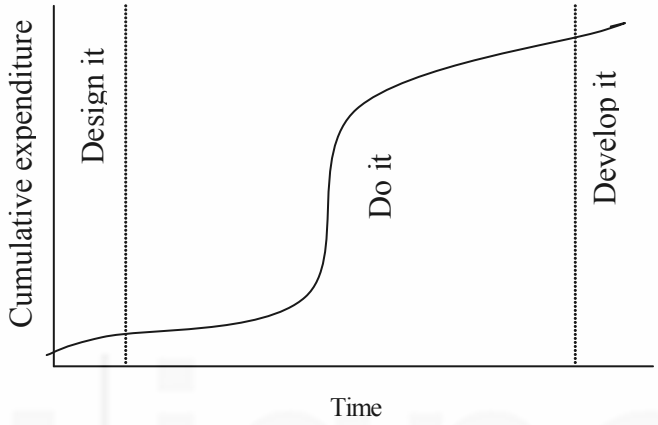

Fig. 4.3: Graph of cumulative expenditure against time

4.3 THE 7-S OF PROJECT MANAGEMENT

The 7-S framework of management issues was promoted by McKinsey and Co., management consultants. Their original 7-S is amended for the project environment, with a description of each of the elements, as shown in Table 4.1.

Table 4.3: The 7-S of Project Management

Element	Description
Strategy	The high-level requirements of the project and the means to achieve them.
Structure	The organisational arrangement that will be used to carry out the project.
Systems	The methods for work to be designed, monitored and controlled.
Staff	The selection, recruitment, management and leadership of those working on the project.
Skills	The managerial and technical tools available to the project manager and the staff.
Style/culture	The underlying way of working and inter-relating within the work team or organisation.
Stakeholders	Individuals and groups who have an interest in the project process or outcome.

Rather than being simply an outcome or a statement, *strategy* is a process. It involves a high-level consideration of objectives, which can be seen as points of principle, rather than activity-level details. Success starts with a rational strategy process, which then guides and informs the decisions made in all areas of the project.

Structure is the arrangement of human resources relative to lines of command and control. A key question for the project manager concerns the nature of this structure.

For example, should the project team be a dedicated, full-time team, or one where staff are 'borrowed' from other parts of the organisation or other organisations, only as and when needed?

Systems are 'the way we work'. Both formal and informal systems will need to be designed or at least recognised for key tasks, including communication and quality assurance. Formal systems can be demonstrated through statements of procedure – simply put, 'under these conditions, we carry out this action'. Informal systems, particularly for information transfer, are far less easy to describe and control. It is normal, however, for these to be the main mode of communication within groups. A theme within the systems element is the focus of the systems on 'process'. That is, ensuring that all activities carried out are contributing to the end objective of the project in a constructive manner. Systems are a recurring theme throughout this text.

Staff need to be selected, recruited and then managed. How they respond to their treatment will have a large impact on the success or otherwise of the project. Yet this element has traditionally been neglected by texts on project management.

Style/culture is part of the 'soft' side of management. Indeed, it cannot be managed in the short term in the same way that the finances of a project, for example, can be managed.

Stakeholders are an important consideration for project managers. Their importance has only recently been realised and methods for the management of expectations and perceptions developed.

The 7-S framework provides a comprehensive set of issues that need to be considered. It also allows classification of tasks within the remit of the project manager, which reduces the complexity of the role. In addition, classifying issues in this manner ensures that the project manager will know where to look to find sources of help if novel situations arise. Knowing that interpersonal problems in a team are aggravated by the style/culture that a project manager promotes provides a means for finding solutions to the problems.

Having considered the framework for consideration of issues by managers, some current issues for project managers are now discussed.

4.4 THE PROEJCT AS A CONVERSION PROCESS

The approach that will be considered in this book is a systems approach. The project is viewed as a conversion or transformation of some form of input into an output. As Fig. 4.4 shows, the inputs are some form of want or need which is satisfied through the process. The project will take place under a set of controls or constraints – those elements generally from outside the project which either provide the basis for any assumptions, or limit the project. The mechanisms are those resources that make the transformation process possible.

Inputs

For project of even moderate complexity there will be some form of project brief - a document which provides a statement of the want or need that is to be transformed by the project. There will be both explicitly stated requirements (original needs) and those which emerge during the course of the project due to the customer's changing needs or perceptions (emergent needs).

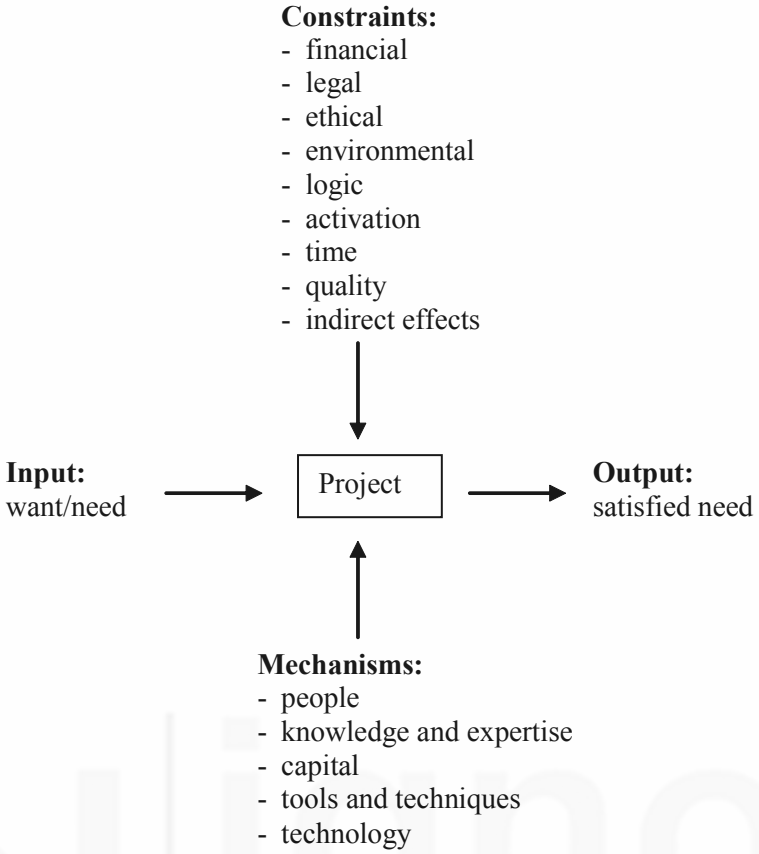

Fig. 4.4: The Project as a conversion process

It is tempting to think of a project brief as an unequivocal statement from the customer. In practice this is rarely the case and there will always be a degree of interpretation required from the project team. Where there is a large creative element required of the project, the brief will need to provide guidance as to what the nature of the desire is, without putting unnecessary limits on the way it is achieved.

Constraints

The brief will also set out the constraints, which may take the form of:

- financial – the amount and timing of release of capital to the project, and the revenue or other benefit it should generate;
- legal – this may not be explicitly stated but there will be legal constraints, e.g a building may not be constructed unless the planning permission for it has been obtained;
- ethical – a survey has shown that the consumers are becoming as concerned about the ethical behaviour of the companies they buy from as they are about the environmental friendliness of the products they buy. While this is at present limited to certain sectors of the community, the need to behave in an ethical manner as well as being seen to behave ethically is a factor in the way that projects are managed;
- environmental – the deluge of environmental legislation that has been generated by the European Union has changed the role of environmental control from a subsidiary issue to one which is at the forefront of management thinking;
- logic constraints – the need for certain activities to have been completed before a project can start;

- activation – actions to show when a project or activity can start;
- time – the biggest constraint for most projects (see current environment);
- quality – the standards by which both the product (the output of the process) and the process itself will be judged; and
- indirect effects – it is practically impossible for any change to take place in isolation. There will be ripple effects which will need to be taken into account at the outset. The output of the project will be in the form of:
  - converted information, e.g. a set of specifications for a new product.
  - a tangible product, e.g. a building.
  - changed people, e.g. through a training project, the participants have received new knowledge and so are part of the transformation process as well as being a product of it.

Outputs

Fig. 4.4 describes the output as a 'satisfied need'. This is a very wide interpretation of the possible outputs of a project and includes, for example, a new building as an output from a construction project; processed information, e.g. in the form of engineering drawings or a report; and people with the necessary skills for a task (the output of a project involving training). The outputs may be tangible or intangible.

Mechanisms

The means or mechanisms by which the output is achieved are as follows:

- people – those involved both directly and indirectly in the project;
- knowledge and expertise – brought to the project by the participants and outside recruited help (e.g. consultants);
- capital – the money that provides the resources;
- tools and techniques – the methods for organising the potential work with the available resources; and
- technology – the available physical assets that will be performing part or all of the conversion process.

This consideration provides the most basic model of the project. The nature of the transformation process will be determined by the environment in which it is taking place. This is the subject of the following section.

4.5 THE RELATIONSHIP BETWEEN PROJECT MANAGEMENT AND LINE MANAGEMENT

Fig. 4.5 shows a conventional management hierarchy with the lines on the diagram representing lines of reporting or responsibility. At the head of each of the major functions within an organisation there will be functional or line managers. These managers have the responsibility for the people who work under them in their departments.

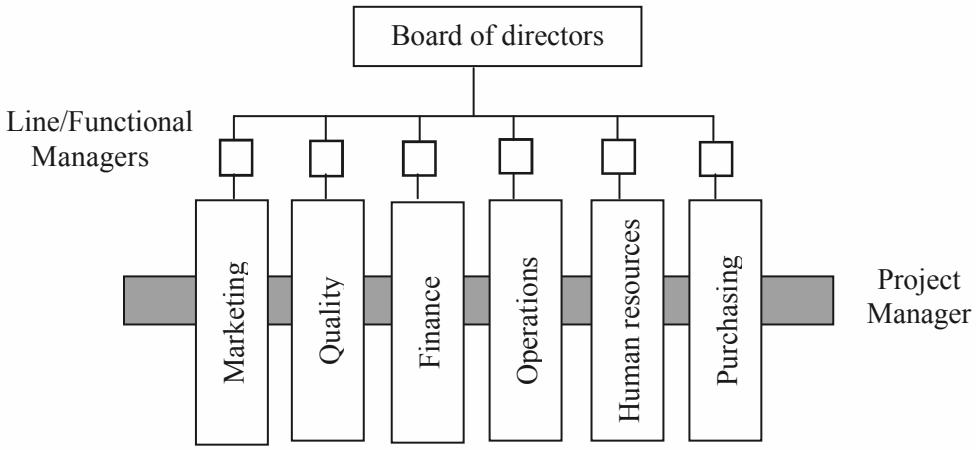

Fig. 4.5: Project organisational structure (for project of medium complexity)

The project manager may have a line management role as well, but is responsible for projects that may run across several functions. The figure shows the project manager being responsible for people drawn from every function in their activities in relation to that project.

The project manager's role differs from that of the line manager in the nature of the task being carried out. Table 4.2 gives the major differences.

Table 4.4: Project Versus Line Management

Line Management	*Project Management*
• responsible for managing the status quo.	• responsible for overseeing change.
• authority defined by management structure.	• lines of authority 'fuzzy'.
• consistent set of tasks.	• ever-changing set of tasks.
• responsibility limited to their own function.	• responsibility for cross-functional activities.
• works in 'permanent' organisational structures.	• operates within structures which exist for the life of the project.
• tasks described as 'maintenance'.	• predominantly concerned with innovation.
• main task is optimisation.	• main task is the resolution of conflict.
• success determined by achievement of interim targets.	• success determined by achievement of stated end-goals.
• limited set of variables.	• contains intrinsic uncertainties.

As Fig. 4.6 shows, the split between tasks that can be considered as maintenance (maintaining the status quo) and innovation is changing. On the figure, the trend is for the line AB to move downwards – increasing the degree of innovation activities required from line managers. The result of this is change in the role of line managers and a reduction in the difference in the roles of line and project managers.

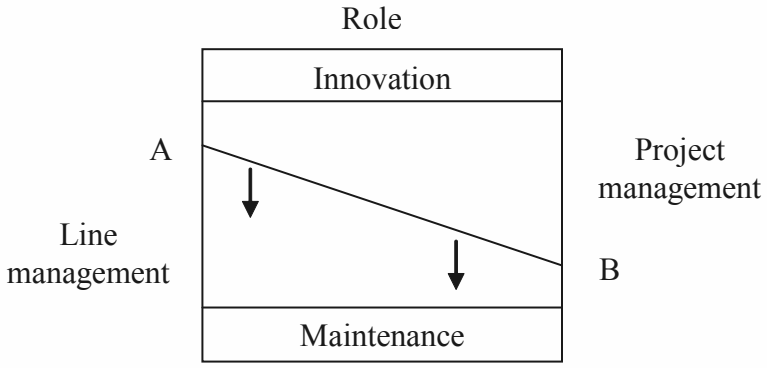

Fig. 4.6: Innovation/maintenance activities in line and project management

The major change in the practice of project management has been its emergence as a management specialism in its own right – just as financial management, operations and marketing have done. For many strategic projects, the function of project management will involve many elements, including:

- financial management – through the preparation of a financial case to meet the needs set out in the project brief;
- personnel management – the identification of skills required, the selection of staff, their motivation and welfare;
- operations management – there are often parts of a project that are repetitive in nature and so can be treated as individual operations;
- purchasing and logistics – the identification of material and service needs, suppliers, their selection and the management of the logistics (location and transport of materials);
- technical specialisms – e.g. new product development, engineering, programming, quality management; and
- marketing – projects generated for both internal and external customers will need to have explicit statements of needs drawn up and then be 'sold' to the customer.

Three project managers with distinctly different roles

1) The site manager of a housing construction project

I am incharge of the construction of the buildings you see around you (he gestured with his hand to the mixture of partially and fully completed properties) and of making sure they go from this stage (he indicates a pile of drawings and building schedules) to the point where we can hand them over to the sales people to sell. Most of the work is supervisory, ensuring that orders are placed and materials arrive on time, people turn up, do the job properly and get paid for it at the end of the week. There are always arguments between the various trades people to resolve and problems just get dumped on the desk. Some of the toughest problems come with the people you have to work with. Some of them will do anything to try to get one over on you – they'll tell you a job is finished when you can see it is only half done. Unless you go and check it yourself you're in trouble. Also, they don't give a damn for my schedule. How do you get a roofer, at four o'clock in the afternoon when it is raining rather heavily (not the words actually used) when you know he has a long drive home, to get back on the roof and finish the job he is doing so that other jobs which rely on this being completed can start at eight o'clock the following morning? It wouldn't be the first time we had to block his car in with a pallet of bricks to stop him leaving'.

2) The quality director (Implementing Total Quality Management)

'The quality director was appointed with the brief to introduce Total Quality Management (TQM) to the company. It was his responsibility to put the proposal as to how it could be done, and then to carry it out. As he described at the outset of the project "(this) is one of the most complex projects that we could undertake at this time". The complexity came because the project would hopefully change the way that everyone in the company thought and worked (i.e. both attitude and procedures). This would have to be done through consultation, training and the demonstration through piloting small-scale improvement activities, that the move towards TQM was worthwhile. The initial phase as part of the proposal process was to carry out a company-wide quality audit to determine attitudes, knowledge and current practice. The results paved the way for the carrying out of targeted efforts where needed most. The first phase of execution was to take the board of directors of the company on awareness training-showing them how working under a TQM environment would benefit them, and what changes would be needed. The next level of management were then trained and so on down the hierarchy until the middle management level. These managers then trained their own people – a process known as "cascading". The project to introduce the new philosophy to the company took several years, and has now moved on to become an accepted way of working. The quality director was initially involved in the management of the introduction process, where the employees and suppliers needed to be convinced that this was a good route for the company to take. His role then became one of project sponsor of a variety of improvement projects, which may be considered as sub-projects of the main one'.

3) Project manager in financial management system implementation

The main roles of the job include:

- organisation – from the design of the system to determining support issues and providing training;
- anticipation of future requirements of the system;
- monitoring of progress of the implementation;
- communication and information – providing progress reports to local team members and national common-interest groups; and
- audit – ensuring the housekeeping, procedures and system security are in order.

The initial system design work involved coordinating with external system designers, the providers of the software and the in-house IT group. Our local area network (LAN) needed upgrading to run the new system. Other organisational issues were the role that consultants would play in the system design and training of users and the allocation of the budget between activities.

Anticipation was required as the requirements of the system would change over its life. For example, higher level monthly indicators of financial performance would need to be provided where they had not been needed before. In addition, a management accounting system would be needed to provide budgetary controls.

The monitoring system we used for the project was PRINCE. This provided a basic set of planning tools, and we filled in the blanks on the planning sheets. A team was set up to monitor progress against the plan.

4.6 THE ROLE OF STRATEGY IN PROJECT MANAGEMENT

There are three levels at which the project manager can have an influence. These are the strategic, tactical and operational levels. For too long, the subject of project management has focused on the tactical and operational levels, ignoring its role in the development and deployment of strategy. This has resulted in:

- projects being carried out in a reactive mode with project managers having little or no input to the strategy process;
- a lack of definable objectives for projects; and
- inevitable conflicts with line managers over resources.

Having project managers who understand the strategy process and who can make an input to it is the first stage in achieving success. The strategy is like a set of principles that guide and inform the actions and decisions of managers. Without this, there is unnecessary chaos – people go in their own direction, to the detriment of the organisation in which they are working.

The term *strategy* needs to be defined. It is about setting objectives for an organisation and providing a path for it to progress towards those objectives. Good strategy is considered as central to success in any organisation, but its definition cannot be universally agreed. The major classifications of strategy are either in terms of:

- the environment in which an organisation exists (relative to competitions, for example through achieving cost advantage); or
- in an absolute sense, as a statement of the *vision* for the organisation (e.g. to have a market presence in every country in the world). Both of these approaches have relevance in the context of the project management.

Strategy in the context of project management is the outcome of a *strategy process.* It is through the consideration of the process that the outcome will be assured. This process includes two key elements: assessment of the present and anticipation of the future.

Furthermore, this process is conducted at two levels – the organisational and project levels. At the organisational level, the aspects of interest are external to the project but those *policies* will affect its objectives. At the project level, these are internal aspects that are generated by the project manager and refer to the project specifics. As a minimum requirement, the project strategy must be in line with the organisational strategy; not in conflict with it. Ensuring that this is achieved in a theme that is expanded in the following section.

Project strategy

The conventional approach to strategy in projects requires the manager to consider three key elements – time, cost and quality. If these can be objectively defined, this provides the goals for the project. This will be considered first. We then need to consider the further element of *flexibility*.

All three – time, cost and quality – can be considered as having two elements. The first is the element of *performance*, expressed as:

- What is the shortest possible project duration?
- What is the lowest cost?
- What is the highest level of quality that can be achieved?

The second element is *conformance*. This is a measure of the reliability required of the project system, expressed as:

- Can the project be guaranteed to be delivered on time?
- Will the project finish within budget?
- Will the project meet the specified level of quality?

The mechanisms by which the project manager assures conformance are different from those that ensure performance. For example, by selecting low-cost suppliers, the project manager may attempt to ensure that the project is delivered at minimum cost (performance). Whether it is in fact deliverable is determined by the actions of that manager to secure guarantees that the price (in addition to delivery and quality) will be achieved in practice (conformance).

Table 4.5: Conformance versus Performance Attributes of Time, Cost and Quality

	Time	Cost	Quality
Performance	Shortest possible	Cheapest possible	Highest level
Conformance	As planned	As budgeted	As specified

Time and cost criteria are relatively straightforward concepts. In practice, determining whether key objectives have been achieved can be a matter of some argument and commercial significance. However, one of the least understood concepts is *quality*. The key relationship that needs to be explored here is that between expectations and perceptions of customers (and other stakeholders) of both the project process and its outcomes.

The process of project planning – inputs, outputs and the process itself

The process of project planning takes place at two levels. At one level, it has to be decided 'what' happens. This, the tactical-level plan then needs to be converted into a statement of 'how' it is going to be carried out (or operationalised) at the operational level. Fig. 4.7 shows an activity model, as would be used to analyse systems of activity by considering the inputs, controls, outputs and mechanisms (ICOMs) for the activity. The inputs are the basis for what is going to be converted by the activity – in this case the project brief. The output is the project plan, or more specifically the project proposal. The controls provide the activation, the constraints and the quality standards for the planning process in addition to its outputs, and the mechanisms provide the means by which the process can happen.

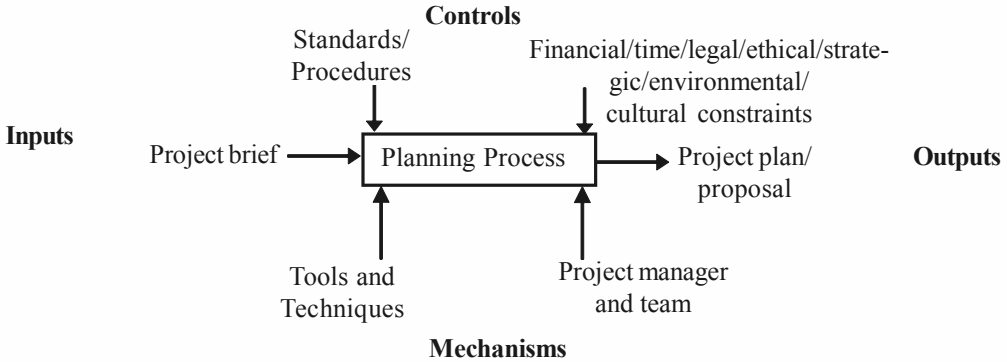

Fig. 4.7: Activity model using ICOMs

At the operational level, the way in which the proposal is generated should not be viewed as a one-off activity but should go through many cycles of suggestion and review before the 'final' document is produced. As Fig. 4.8 shows, the first cycles are to provide the major revisions, where significant changes are made. Once these have been done and the project team is happy with the basic format, the last stages are those of refinement, where small adjustments are made.

It is important for the overview to be verified first, before further effort is committed to planning at a detailed level – as discussed above. The life-cycle of planning in Fig. 4.8 shows the stages that the plan should go through. Cases such as the one given below are examples where the detail was considered before the major issues. As the example shows below, this is very wasteful of management time.

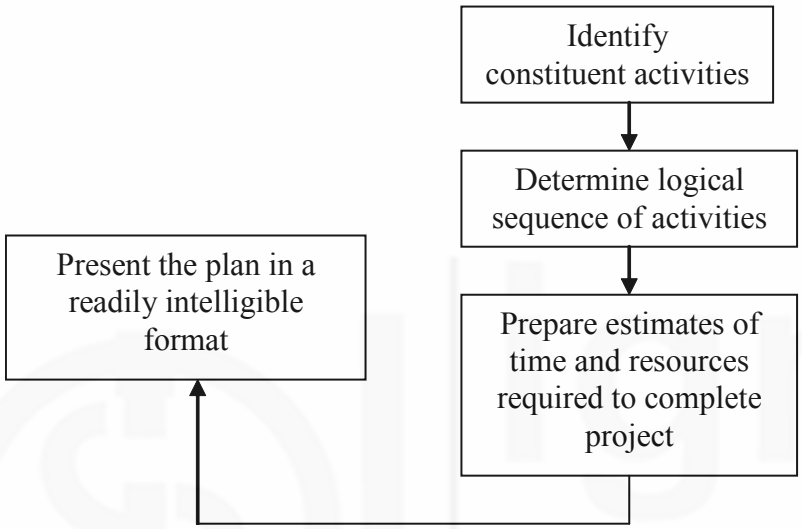

Fig. 4.8: The project planning process

Example – The upside down business plan

Business plan meetings were serious affairs – they always were. The concept was quite attractive – to set up an exclusive nursery school with an appealing teaching method in a smart area of the city. So far so good. This was however, where the rough planning stopped and the group succumbed to the virus that plagues so many projects at this point – detailitus. The discussions were then way laid by the need to have safety tyres on the school minibus and by the detailed wording of the liability insurance. No matter that the lag between the money being spent on the buildings and equipment and any income from fees received would create interest payments that the company could never hope to meet.

The revision/refinement process considers the necessary sub-projects (if any), the results of any numerical analysis (may be financial, resource, risk analysis or some form of mathematical simulation), the element of 'gut feel' (also referred to as the sub-conscious or back-of-the-mind element) as well as experience. The sponsor and other stakeholders will usually have some input to be considered in this process.

Managing the planning process

Most projects of low complexity will bias the ratio of planning: action heavily towards the action. As complexity increases, so does the necessity for a formalised plan. This is both a systematic analysis of the project (which provides its own set of benefits) and an opportunity to show that the project manager has been systematic in the planning

process (by showing the level of consideration that the project manager has given to issues). 'Traceability' has become a major issue in many companies – allowing products to be traced back to records of their constituent parts. The same is required of a project plan. In the event of an unsatisfactory result, for whatever reason, a good plan can show that the planner took every possible precaution to ensure that the result was positive. Conversely, should the project go particularly well, you will have an assignable cause for this – namely your planning.

The benefits of using a systematic methodology in planning include:

- breaking down complex activities into manageable chunks (see work breakdown structure);
- determining logical sequences of activities;
- providing an input to subsequent project management processes, including estimating the time and resources required for the project;
- providing a logical basis for making decisions;
- showing effects on other systems;
- filtering frivolous ideas and activities;
- providing a framework for the assessment of programmes (the post-project review process relies on comparing the achieved result with the original plan, particularly for the purpose of improving the planning process);
- being essential for the revision/refinement process;
- allowing lessons to be learned from practice; and
- facilitating communication of ideas in a logical form of others.

What follows shows how these benefits can be achieved through the application of tried and tested methods, within a systematic framework.

4.7 TIME PLANNING – TOOLS AND TECHNIQUES

The project planning process was described earlier as having four main stages – identify the constituent activities, determine their logical sequence, prepare estimates of time and resource and present the plan in a readily intelligible format. This last step allows the plan to be communicated to all parties involved with the project and analysis. The general approach to planning involves starting with a rough overview and conducting revisions of this through the process shown below. This is known as *iterative* – it involves going through the cycle several times, to test the effects of the changes you make on the outcomes. The objective is to make the major revisions early in the planning cycle and then make minor refinements to the plan. Following these, there should be a period of stability otherwise the plans lose credibility. The revision – refinement cycle is shown in Fig. 4.9.

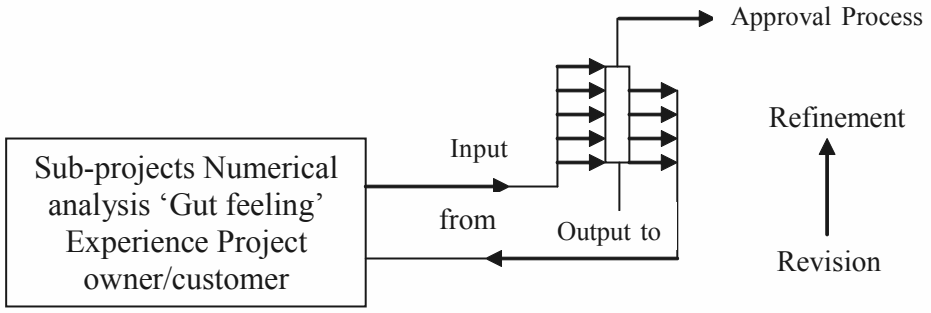

Fig. 4.9: Planning sequence

This section is concerned with developing detailed time plans. The techniques that follow are of increasing complexity. However, despite the diversity of projects being considered, one area of commonality between project managers is the use of various graphical techniques to:

- allow the construction of a comprehensive but comprehensible picture of the project activities; and
- communicate this with others.

The preference for graphical techniques is more than 'a picture telling a thousand words'. The whole revision/refinement process is built around people being able to understand what is going on. This is known as visibility, and is an essential feature of both the plan and the process.

The purpose of the graphical techniques is to illustrate the relationships between the activities and time. The simplest form is a horizontal bar chart, as in Fig. 4.10. This shows activity a represented by the bar starting at time 1 and finishing at time 3. Multiple activities can be built up on the same chart, using the same timescale.

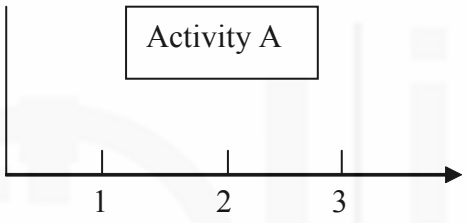

Fig. 4.10: Horizontal bar chart: activity A starts at time 1 and finishes at time 3

The following example involves a dissertation planning exercise. The student has a number of options as to how to present the information. The supervisor, being a busy person, has asked for the information to be presented in graphical form.

Time estimation – learning curve effects

Watching a skilled craftsperson at work shows how a highly intricate task can be learned and carried out so that it is made to look easy. Gaining such a level of skill requires years of training and practice (and many mistakes). A project rarely has such an opportunity to gain advantage through repetition. There will, however, be repetitive elements to any activity, particularly during the execution phase. Where this occurs, the time taken each time the task is carried out will decrease as the person becomes familiar with the methods. Subsequent improvements in speed are seen to become smaller over time. This can be quantified using the following formula:

$Y_x = Kx^n$

Where

x = the number of times the task has been carried out,

Y_x = time taken to carry out the task the xth time,

K = time taken to carry out the task the first time, and

n = $\log b / \log 2$ where b = learning rate.

Example

A team is set up to carry out a quality audit of ten departments. The first audit takes four days as the auditors are unfamiliar with the procedures. The second audit takes three. After a period of time, the minimum audit time is reached, and very little further improvement is seen. We can plot this progression as shown in Fig. 4.11.

If we wish to find out how long the eighth audit will take, we need to calculate the learning rate, *b*. The following values can be assigned from the above information:

x = the number of times the task has been carried out = 2

Y_x = time taken to carry out the task the xth time = 3

K = time taken to carry out the task the first time = 4

n can be calculated

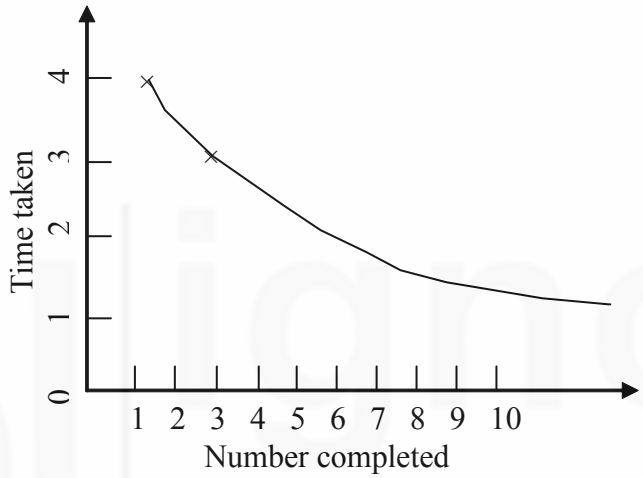

Fig. 4.11: Learning curve effect on time taken

Putting these valued in:

$$3 = 4(2)^n$$
$$2^n = ¾$$
$$n.\log 2 = \log(3/4)$$
$$n = -0.1249 / 0.4149$$
$$n = \log b / \log 2 = -0.4149$$
$$\log b = -0.1249$$
$$b = 0.75$$

From this we can say that the project has a 75 per cent learning curve.

This can also be seen intuitively, as another way of expressing the learning curve is to say that every time the total number of audits completed doubles, the time taken for the last audit will be the learning percentage multiplied by the original time. In this case as the number of audits doubled from 1 to 2, the time decreased from 4 to 3. The percentage is therefore ¾ = 75 per cent. As the number of times the audit is done increases, the times taken will decrease as shown in Table 4.4.

Table 4.6

Audit no.	Time taken (days)
1	4
2	3
3	2.54

4	2.25
5	2.05
6	1.90
7	1.78
8	1.69

4.8 PROJECT STRUCTURES – TEAMS AND ORGANISATION

The gathering together of individuals with the aim of making them a cohesive whole and ensuring the benefit of all stakeholders is a fundamental role of most project managers. This is at best likely to be a very hit-and-miss process (very few will naturally achieve both good social interaction and commercial success) and, at worst, financially disastrous. There have been many attempts to describe the best mixture of personalities that will ensure that the group dynamics are right and some of these will be discussed here. There are project issues. A strategic issue is how the project management structure fits in with the structure of the organisation as a whole. The ideas of the various forms of matrix are also discussed.

4.9 THE ROLE OF TEAMS

The organisation of people into *ad hoc* groups takes advantage of bringing together individuals from different specialisms (marketing, engineering, etc.) as needed for a project task. It is notable that as organisational size increases, the degree of specialism of individuals is increased. Since the days of Henry Ford, large organisations have been organised by functional specialism into 'chimneys'. The notion is that by grouping all the specialisms together, the arrangement is very efficient, as when you need that function to be performed, there is an obvious resource to draw on. Quite reasonably, from the point of view of the individual, career paths are well defined and basic administration systems are geared to this way of working. Give a group the task of setting up and running their own business and, 99 per cent of the time, the first task they set themselves is to allocate roles as heads of the various line functions. This is typically the case in many traditional industries, but has been shown to be detrimental to the creativity of individuals and the responsiveness of the organisation to changing market needs.

However, as discussed in, one single function will rarely provide a customer's entire need or want. To do this requires cross-functional activity, i.e. the linking of the activities of more than one functional area. Functional arrangements tend to lead individual managers to build their own empires by creating work for themselves – regardless of whether this is value-adding for the organisation as a whole. Departmental head-count is considered to be a measure of the status of the individual manager and the importance of their function.

The conventional management hierarchy or pyramid (see Fig. 4.13) has provided the basis on which the majority of organisations are ordered. The style is militaristic and there may be 11 or more layers in the chain of command (foot soldier to top-ranking general). Other structures include organisation by:

- Product group;
- Customer type (e.g military / civil);

- Geographical area (of their operations or the customers they serve); and
- The function they perform.

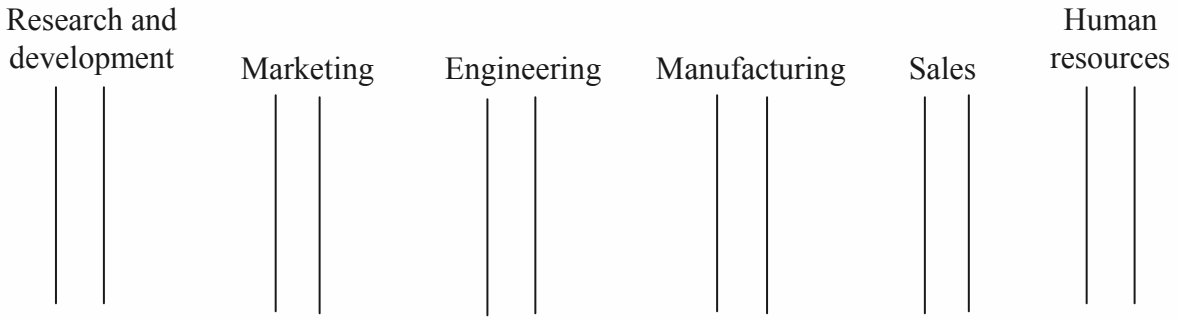

Fig. 4.12: Management chimneys

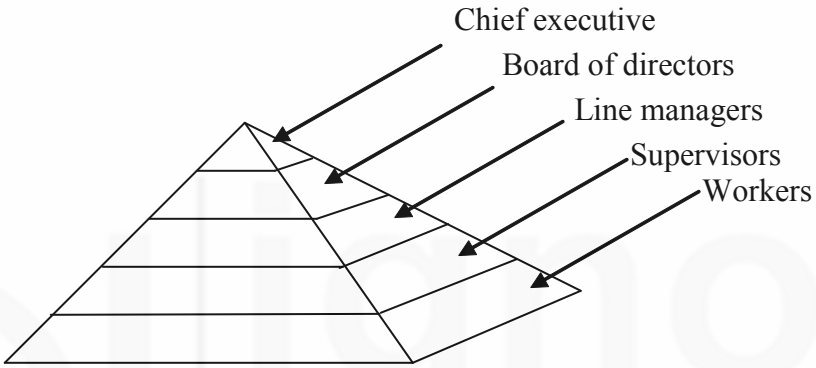

Fig. 4.13: Hierarchical pyramid

It is common to see a mixture of these forms of organisation being employed depending on the nature of the business and the degree of vertical integration in the supply stream (how many of the suppliers/customers are owned by the same organisation).

Where a project can be defined as having more than one function involved (which systems and strategy projects are almost bound to have) it is merging as one of the roles of the project management specialist to define possible organisational forms. Many authors note that project managers themselves rarely have a choice about how the project organisation is arranged and, consequently, have to use what are often inappropriate structures. The emerging strategic importance of the project manager means that they are likely to have more input in determining the structures within which they work in the future.

The nature of the work organisation is important as it:

- defines responsibility and authority;
- outlines reporting arrangements;
- determines the management overhead (costs);
- sets the structure behind the organisational culture; and
- determines one group of stakeholders in project activities.

As organisations have expanded, so the functions have often become less integrated by, for example, geographical separation. Walls, both literal and metaphorical, are

constructed around them. In order to try to enforce communication between departments, many organisations use 'dotted-line responsibility'. Here an individual may have a responsibility to one functional manager, with a dotted-line responsibility to another. This device has been used frequently to ensure that certain individuals do not engage in empire-building. In manufacturing industry, this was done by manufacturing directors who wanted to ensure that they retained responsibility for the running of the entire manufacturing operation. Consequently, when it became fashionable to employ a quality manager, they were not given any direct staff, but inspection and other quality staff would work for the manufacturing manager, while given a dotted-line responsibility to the quality manager (indicating that they were linked to the goals of this part of the operation). It did still leave power in the hands of the manufacturing people.

In addition to the dotted-line responsibility, detailed administrative procedures are introduced to ensure that some form of integration takes place. Often involving interminable meetings and mountains of bureaucracy, they are an attempt to make the organisation perform acts which it is not designed to do, i.e. integrate. Sloan's General Motors in the US in 1930's was run using considerable command-and-control structures – based on the premise that 'whoever holds the purse strings, commands'.

4.10 CONTROL SYSTEMS

The most basic model of a control system is shown in Fig.4.14. In this diagram, the output of a process is monitored by some means to determine the characteristics of the output. This data is interpreted and then fed back to the input to the process. On receipt of this information, adjustments are made to the process. By using this kind of 'feedback control system', the performance of the process can be guided by the application of corrective actions to keep it within certain limits (having defined 'acceptable deviation' from the desired performance).

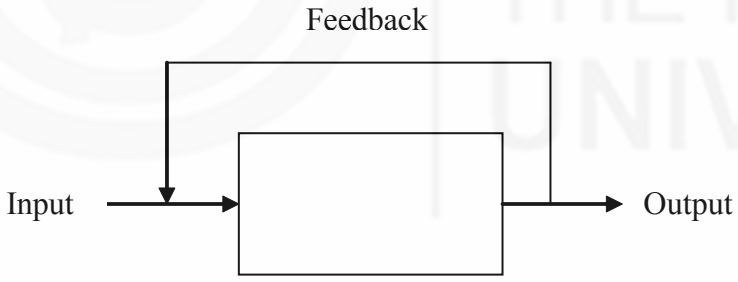

Fig. 4.14

The monitoring point should be set so as to take a representative measure of the characteristics in which you are interested. The nature of these will be discussed in the following sections. The action that is taken based on the feedback is the 'corrective' or 'control' action which seeks to remedy the deviation that has been noted. The intention is to keep the system stable through regular corrective action. The nature of the feedback itself is important.

Example of a control system – corrective actions and stability in a physical system

Try balancing a ball in the centre of a tray – start it moving and try to bring it to rest again ten centimetres away form the start point. Very quickly the movements of the tray get larger and the movement of the ball will generally become anything other than

diminishing as the ball passes over the point without stopping. The system rapidly becomes unstable as the movement of the ball has passed out of control and soon leaves the tray completely. This is the result of instability in the system – the brain cannot make the necessary corrective action to bring it back to rest and so the control actions get larger as the ball exhibits behaviour which is considerably different from that which is required.

4.11 CONTROL OF MAJOR CONSTRAINTS – COST AND TIME

The detailed systems for controlling quality are novel in many industries. The systems for controlling cost and time have been in use for far longer, but still require a considerable input from the project manager in their establishment and execution. The attributes of cost and time are interlinked as previously discussed. The need is for practical tools that will identify when corrective actions are required and what they should be. The role of the project manager in cost control may be stated as:

- setting up the cost control system in conjunction with the needs and recommendations of the financial function;
- allocating responsibilities for administration and analysis of financial data;
- ensuring costs are allocated properly (usually against project codes);
- ensuring costs are incurred in the genuine pursuit of project activities; and
- checking other projects are not using your budget.

The measurement that is often taken to consider progress using cost as a measure is 'sunk costs'. That is the measure of what has been spent to a particular point in time on activities. It is notoriously unreliable as a measure of how much has been achieved, as it is perfectly possible for a project to be 80 per cent complete but to have incurred 95 per cent of the budget allocated to it. Controlling cost overruns clearly needs more than just a raw figure such as expenditure incurred. The 'earned value' concept is one attempt to make the measure more meaningful.

'The earned value of a task is the approved budget allocated to perform the task. When the task is complete, the budget has been earned.'

4.12 MANAGING AND CONTROLLING SUPPLIERS AND CONTRACTORS

For many construction projects as much as 80 per cent of the revenue generated by a project is spent with suppliers and contractors. The design and control of the purchasing function is clearly a management specialism in its own right, but is a function in which the project manager has an input. Some of the purchasing responsibility is also typically devolved to the individual project, although it is more usual for the majority to be handled centrally. There are clear advantages to each form of purchasing, as shown in Table 4.7.

Table 4.7

	Centralised Purchasing	Localised Purchasing
Advantages	• purchasing power due to aggregation of orders. • better materials utilisation and stock management. • economies of staffing. • standardisation of purchasing procedures.	• local knowledge of suppliers. • low organisational inertia. • local management control. • enhanced supplier relationships.

The trade-offs will need to be optimised on a project-by-project basis. The objectives of the purchasing system are similar – to satisfy what are termed 'the five rights'. These are inter-dependent characteristics of a supplier or contractor depending on their ability to deliver:

- the right quantity;
- at right quality;
- at the right price;
- at the right time and place; and
- the right supplier.

The quantity of goods or services (contractors are generally assumed to deliver a service) is determined from the schedules drawn up with the plans. Where there have been changes these are built in and the quantity calculated. The quality of goods and services may be determined through:

- trial supply of goods or services;
- prior reputation; and
- certification or assessment of their quality systems.

Where contractors are hired on an individual basis, the recruiter may also seek membership of a particular professional body and possibly the contractor to provide their own legal indemnity insurance.

Achieving a purchasing decision at the right price is a difficult debate. In project organisations there is often the need for long-term relationship to be built up between buyers and supplier, though the relationship for that particular project may be fairly short. There are clear gains to be made by applying pressure on the price to obtain the cheapest supply. In the long term, however, the supplier may go out of business or may simply economise in ways that cost you money elsewhere.

'End the practice of awarding business on the basis of a price-tag. Purchasing must be combined with design of product, manufacturing and sales to work with the chosen supplier: the aim is to minimise total cost not merely initial cost.'

The best supplier may not then be the cheapest, as there is often a trade-off in other areas.

Achieving the right time and place is the basis of much literature and the predominant complaint that industrial purchasers have about suppliers. The rating of suppliers and

regular performance reviews can keep this as an issue for them. It is also one advantage that a degree of centralisation can have for the purchasing function – that of being able to track supplier performance on the basis of criteria such as late delivery if paperwork to place the order takes six weeks to be processed by the purchasing function. Giving suppliers the longest possible time in which to fulfil an order is going to be beneficial to both parties in the long term.

Being the right supplier clearly has dependence on the other four categories, but is included to start the discussion as to the way in which one selects suppliers. The choice base on price alone has been shown to provide possible short-term gains which can be more than countered in the longer term. There are several other factors which should be considered.

- Are choices made on the basis of a 'free lunch? The expansion of the corporate hospitality industry over the last ten years has been immense, for example. This has been paralleled by efforts by many companies to be seen to be behaving ethically and state publicly that their staff will not accept gifts, however small, from suppliers.
- How are orders conveyed, with what frequency and how do the suppliers really know what your requirements are? Also, they often have expertise in both the design of their products and their application, which, should be used as a source of knowledge and improvement.

4.13 PROJECT COMPLETION AND HANDOVER

The major elements that will require the attention of the project manager during this phase are:

- ensuring there is an incentive for the project to be finished and that activities are completed;
- ensuring documentation is provided;
- closing down the project systems, particularly the accounting systems;
- constructing the immediate review of activities – providing a starting point for all improvement activities;
- disposal of assets that are surplus to requirements;
- providing the best basis for future projects;
- ensuring that all stakeholders are satisfied; and
- providing the basis for future reviews of activities.

Documentation

The purpose of providing documentation is:

- to give the customer of the output of the project guidance on the operation and maintenance of the item provided;
- to provide evidence that the project has been completed in a proper manner;
- to provide the basis for one form of the assessment activity; and
- to allow any future work on the same system to be base on good information rather than assumptions.

The close-down activities should form part of the detailed planning and the derivation of checklists can provide an objective means of ensuring that the finishing tasks are carried out. Such a checklist is:

- an *Iaide-memoire* in addition to formal work allocation;
- evidence that the close-down tasks were planned; and
- evidence, when completed, that the tasks were carried out, by whom and when.

Check Your Progress Exercise 1

Note: a) Use the space below for your answers.

b) Compare your answers with those given at the end of the unit.

1) Define project and explain the key activities involved with project management.

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2) What are the different phases of project management?

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3) Explain the stages in development of project life cycle.

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4) What are the 7-S of project management?

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5) What is the relationship between project management and line management?

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6) What is the role of strategy in project management?

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7) Explain the role of teams in project management?

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8) Explain the process of controlling suppliers and contractors.

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4.14 LET US SUM UP

Project Management is no longer about managing the sequence of steps required to complete the project on time. It is about systematically incorporating the voice of the customer, creating a disciplined way of prioritising effort and resolving trade-offs, working concurrently on all aspects of the project in multi-functional teams, and much more. It involves much closer links between project teams and downstream activities, e.g. in new product development integration with manufacturing, logistics and after-sales support – in this case 80 per cent of costs are determined before they take over.

There are huge opportunities for eliminating wasted time and effort in almost every project. In manufacturing, Toyota estimate that only 5 per cent of activities actually

add value, 35 per cent are necessary but do not add value, while the remaining 60 per cent is pure waste – Muda in Japanese. By halving the effort in designing a new car, they show this Muda can be reduced by good project management. Every project manager in the future has not only to manage their own project but to seek new ways of eliminating the Muda in their systems so they can do more for less, and more quickly next time.

Projects make up around 50 per cent of all work carried out. They can therefore be termed 'an economically important' category of activities. That makes the subject of their management worth studying. However, it is not unusual to hear the question from students at the start of a course, *' It's just common sense, isn't it?* To some extent they are right. After all, there is nothing inherently difficult about the concepts which are discussed here (with the exception of some of the mathematical modelling). How is it that the majority of organisations are so poor at managing projects? The answer can be found in the definition of common sense as *'the obvious after it has been explained'*. It is observed that common sense is not so common, and many of these apparently obvious aspects of the subject are neglected.

4.15 KEY WORDS

Project	:	A goal oriented non-repetitive activity.
Project Management	:	Includes planning, organising, directing and controlling activities.
Three Phases of Project Management	:	Design it, do it and develop it.
Life Cycle of Project	:	Consideration of how the level of activity varies with time
Conversion Process	:	Conversion of some form of input into a output.
Strategy	:	Systematic analysis and planning out activities for a favourable outcome.
Performance Attributes	:	Time, Cost and Quality.
Management Hierarchy	:	Layers in the chain of command.
Constraints	:	Restrictions in implementation of actions.

4.16 ANSWERS TO CHECK YOUR PROGRESS EXERCISE

Check Your Progress Exercise 1

1) A project can be defined by ISO 10006:2003 as "unique process consisting of a set of coordinated and controlled activities with start and finish dates, undertaken to achieve an objective conforming to specific requirements including constraints of time, cost and resources". Project management includes planning, organising, directing and controlling activities in addition to motivating what is usually the most expensive resource on the project – the people. Planning involves deciding what has to be done, when and by whom. The resources then need to be organised through activities such as procurement and recruitment. Directing their activities towards a coherent objective is a major management role. The activities also need controlling to ensure that they fit within the limits (e.g. financial) set for them.

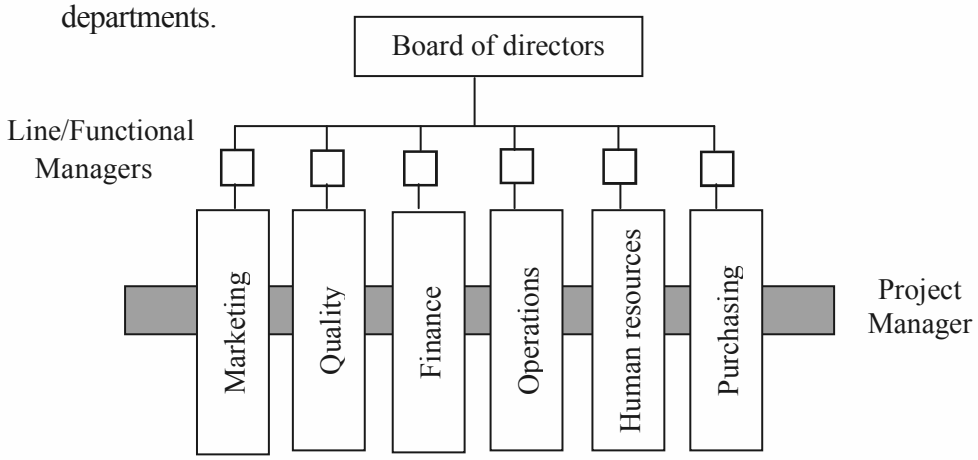
2)
- *Design it* – identify the need that the project will serve, construct models to show how the needs will be developed, evaluate these to determine the optimum process for the task and minimise risk;
- *Do it* – carry out the project in line with the models or plans generated above; and
- *Develop it* – improve the models and processes in the light of the experience gained from the project, incorporating the check/study and act parts of the Deming cycle.

3) The *planning* stage involves the formulation and revision of statements of intended activity, whether formalised or otherwise. The doing is the time when the project is carried out (the direct value-adding phase). The *check/study* phase involves a critical appraisal of both the project output (was a good result achieved?) as well as the process (was it carried out as well as it could have been?) the *act* stage is that phase when the project process is considered to see how the lessons learned and gleaned from the review could be channelled back to the people involved in the process.

4) **The three phases of project management**

Phase	Key Issues	Fundamental Questions
Design it	Project and organisational strategy, goal definition, modelling and planning, estimating, resource analysis, conflict resolution and justification.	What is to be done? Why is it to be done? How will it be done? Who will be involved in each part? When can it start and finish?
Do it	Organisation, control, leadership, decision-making and problem-solving	How should the project be managed on a day-to-day basis?
Develop it	Assessment of process and outcomes of the project, evaluation, changes for the future	How can the 'management process' be continually improved?

5) Figure shows a conventional management hierarchy with the lines on the diagram representing lines of reporting or responsibility. At the head of each of the major functions within an organisation there will be functional or line managers. These managers have the responsibility for the people who work under them in their departments.



Project organisational structure (for project of medium complexity)

6) The strategy is like a set of principles that guide and inform the actions and decisions of managers. Without this, there is unnecessary chaos – people go in their own direction, to the detriment of the organisation in which they are working. Good strategy is considered as central to success in any organisation, but its definition cannot be universally agreed.

Strategy in the context of project management is the outcome of a *strategy process*. It is through the consideration of the process that the outcome will be assured. This process includes two key elements: assessment of the present and anticipation of the future.

The conventional approach to strategy in projects requires the manager to consider three key elements – time, cost and quality. The first is the element of *performance*, the second element is *conformance*.

7) The organisation of people into *ad hoc* groups takes advantage of bringing together individuals from different specialisms (marketing, engineering, etc.) as needed for a project task. It is notable that as organisational size increases, the degree of specialism of individuals is increased. The notion is that by grouping all the specialisms together, the arrangement is very efficient, as when you need that function to be performed, there is an obvious resource to draw on.

8) The design and control of the purchasing function is clearly a management specialism in its own right, but is a function in which the project manager has an input.

Purchasing must be combined with design of product, manufacturing and sales to work with the chosen supplier: the aim is to minimise total cost not merely initial cost.' The best supplier may not then be the cheapest, as there is often a trade-off in other areas. Achieving the right time and place is the basis of much literature and the predominant complaint that industrial purchasers have about suppliers. The rating of suppliers and regular performance reviews can keep this as an issue for them. It is also one advantage that a degree of centralisation can have for the purchasing function – that of being able to track supplier performance on the basis of criteria such as late delivery if paperwork to place the order takes six weeks to be processed by the purchasing function. Giving suppliers the longest possible time in which to fulfil an order is going to be beneficial to both parties in the long term.

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- How are orders conveyed, with what frequency and how do the suppliers really know what your requirements are? Also, they often have expertise in both the design of their products and their application, which, should be used as a source of knowledge and improvement.

4.17 SUGGESTED READING

ISO 10005:2003 *Quality Management Systems-Guidelines for Quality Management in Projects*

Kerzner.H - *Project Management*

Obeng.E – *The Role of Project Management in Implementing Strategy*

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Stewart, Dorothy M (ed) (1990) *Handbook of Management Skills*, Gower Publishing Co,London.