Chapter 1
Projects and Project Management

This chapter describes the various aspects of project management, from what a project is through the various stages of a project to the key requirements for project success.

1.1 The function of project management

Managing projects is one of the oldest and most respected accomplishments of the human race. One stands in awe of the achievements of the builders of the pyramids, the architects of ancient cities, the masons and craftsmen of great cathedrals and mosques; of the might of labour behind the Great Wall of China and other wonders of the world. Today's projects, too, command attention. People are fascinated by the sight of the Americans landing on the moon, impressed by the latest Olympic Games infrastructure and enthused by the launch of the iPOD. As a new project is commissioned, as a major building rises, as a new computer system comes online or as a spectacular entertainment unfolds, a new generation of observers is inspired.

All of these endeavours are projects, like the many thousands of similar task-orientated activities, and yet the skills employed in managing projects, whether major ones such as these or more commonplace ones, are not well known other than to the specialists concerned. The contribution that knowledge of managing projects can make to management at large is greatly underrated and generally poorly known. For years, project management was derided as a low-tech, low-value, questionable activity. Only recently has it been recognised as a central management discipline. Major industrial companies now use project management as their principal management style. 'Management by projects' has become a powerful way to integrate organisational functions and motivate groups to achieve higher levels of performance and productivity.

1.2 Projects

A project can be any new structure, plant, process, system or software, large or small, or the replacement, refurbishing, renewal or removal of an existing one. It is a one-off investment. In recent times projects have had to meet the demands

of increasing complexity in terms of technical challenge, product sophistication and organisational change.

One project may be much the same as a previous one and different from it only in detail to suit a change in market or a new site. The differences may extend to some novelty in the product, in the system of production or in the equipment and structures forming a system. Every new design of car, aircraft, ship, refrigerator, computer, crane, steel mill, refinery, production line, sewer, road, bridge, dock, dam, power station, control system, building or software package is a project. So are many smaller examples, and a package of work for any such project can, in turn, be a subsidiary project.

Projects thus vary in scale and complexity from small improvements to products to large capital investments. The common use of word 'project' for all of them is logical because every one is:

- an investment of resources for an objective;
- a cause of irreversible change;
- novel to some degree;
- concerned with the future;
- related to an expected result.

A project is an investment of resources to produce goods or services – it costs money. The normal criterion for investing in a proposed project is therefore that the goods or services produced are more valuable than the predicted cost of the project.

To get value from the investment, a project usually has a defined date for completion. As a result, the work for a project is a period of intense engineering and other activities but which is short in its duration relative to the subsequent working life of the investment.

A number of definitions of the term *project* have been proposed, some of which are presented below.

- The Project Management Institute (PMI), USA, defines a project as 'a temporary endeavour undertaken to create a unique product or service'.
- The UK Association of Project Managers defines a project as 'a discrete undertaking with defined objectives often including time, cost and quality (performance) goals'.
- The British Standards Institute (BS 6079) defines a project as 'a unique set of co-ordinated activities, with definite starting and finishing points, undertaken by an individual or organisation to meet specific objectives with defined schedule, cost and performance parameters'.

From the aforementioned definitions it may be concluded that a project has the following characteristics:

- temporary, having a start and finish;
- unique in some way;

- specific objectives;
- the cause and means of change;
- risk and uncertainty;
- the commitment of resources: human, material and financial.

1.3 Project management

The definition of project management stems from the definition of a project and implies some form of control over the planned process of explicit change.

- The PMI defines project management as 'the art of directing and coordinating human and material resources through the life of a project by using modern management techniques to achieve predetermined goals of scope, cost, time, quality and participant satisfaction'.
- The UK Association of Project Managers defines project management as 'the planning, organization, monitoring and control of all aspects of a project and the motivation of all involved to achieve project objectives safely and within agreed time, cost and performance criteria'.
- The British Standards Institute (BS 6079) defines project management as 'the planning, monitoring and control of all aspects of a project and the motivation of all those involved to achieve the project objectives on time and to cost, quality and performance'.

The common theme is that project management is the management of change, but explicitly planned change, such that from the initial concept the change is directed towards the unique creation of a functioning system. In contrast, general or operations management also involves the management of change, but their purpose is to minimise and control the effects of change in an already constructed system. Therefore, project management directs all the elements that are necessary to reach the objective and those that will hinder the development. It should not be forgotten that projects are managed with and through people.

Project management is needed to look ahead at the needs and risks, communicate the plans and priorities, anticipate problems, assess progress and trends, get quality and value for money, and change the plans if needed to achieve objectives.

The needs for project management are dependent upon the relative size, complexity, urgency, importance and novelty of a project. The needs are also greater where projects are interdependent, particularly those competing for the same resources.

Each project has a beginning and an end, and hence it is said to have a life cycle. A typical life cycle is defined by Wearne (Figure 1.1) as the nature and scale of activity changing at each stage. Each stage marks a change in the nature, complexity and speed of the activities and the resources employed as a project proceeds. Widely different terminologies for the various aspects of project management are used in different industries, but they can all be related to this diagram.

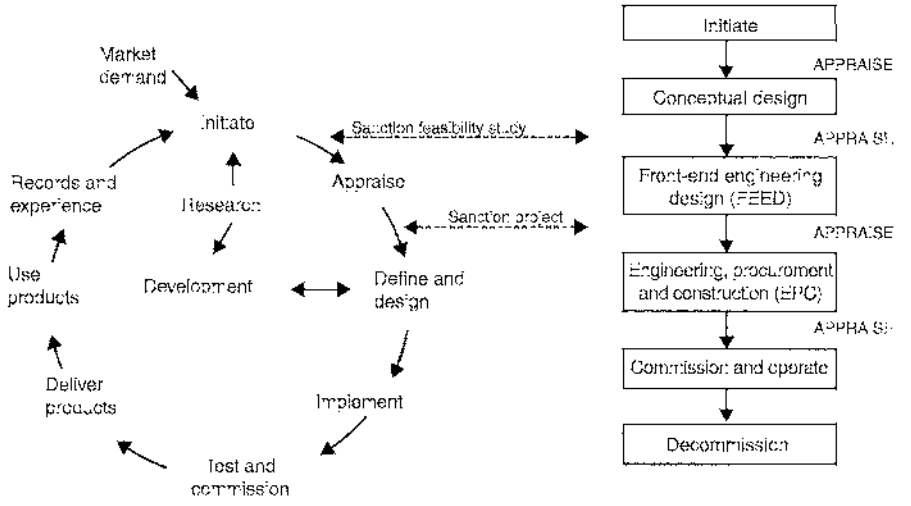

Figure 1.1 Project life cycle.

The duration of the stages vary from project to project, sometimes with delays between one and the next. They can also overlap. Figure 1.1 shows the sequence of starting them. It is not meant to show that one must be completed before the next is started. The objective of the sequence should be to produce a useful result so that the purpose of each stage should be to enable the next to proceed.

1.4 Project initiation

As shown in Figure 1.1, a project is likely to be initiated when whoever is its promoter predicts that there will be a demand for the goods or services the project might produce. The ideas for the project should then draw on records and experience of previous projects and the results from research indicating new possibilities. These sources of information ought to be brought together at this stage of a project.

Usually at this stage there will be alternative ideas or schemes that seem likely to meet the demand. Proceeding further requires the promoter to authorise the use of some resources to investigate these ideas and the potential demand for the project. The term 'sanction' is used here to mean the decision to incur the cost of these investigations. The cycle then proceeds to appraise the ideas to compare their predicted cost with predicted value.

'Feasibility' study

The appraisal stage is often referred to as the feasibility stage or as the feasibility study. Appraisal actually involves two key decisions – first a decision on the viability of the project and, if this is positive, a decision on the most feasible

option for the project. The outputs from this phase can only be probabilistic, as they are based on predictions of demand and of costs whose reliability varies according to the quality of the information used, the novelty of the proposals and the amount and quality of the resources available to investigate the risks that could affect the project and its useful life. The key feature of this phase is the decision as to whether or not the project is viable, that is, high risk levels do not necessarily mean that the project will not go ahead but rather that a higher rate of return is required.

Repetition of the work up to this point is often needed after the first appraisal, as the results of the feasibility study may show that more information is needed on the possible demand or the conclusions of the appraisal may be disappointing and revised ideas more likely to meet a demand are called for. More expenditure has to be sanctioned to do so. Repetition of the work may also be needed because the information used to predict the demand for the project would have changed during this time. Feasibility studies may therefore have to be repeated several times.

Concluding this work may take time. Its outcome is quite specific: the sanctioning or the rejection of a proposed project. If a project is selected, the activities change from assessing whether it should proceed to deciding how best it should be realised and to specifying *what* needs to be done.

Design, development and research

Design ideas are usually the start of possible projects, and alternatives are investigated before estimating costs and evaluating whether to proceed any further. The main design stage of deciding how to use materials to realise projects usually follows evaluation and selection, as indicated in Figure 1.1. The decisions made during design determine almost entirely the quality and cost and therefore the success of a project. Scale and specialisation increase rapidly as it proceeds.

Development in the cycle refers to the experimental and analytical work to test the means of achieving a predicted performance. Research ascertains properties and potential performance. The two are distinct in their objectives. Design and development share one objective – that of making ideas succeed. Their relationship is therefore important, as indicated in Figure 1.1.

Most of the design and supporting development work for a project usually follows the decision to proceed. Decisions may be taken in sub-stages so as to investigate novel problems and review predictions of cost and value before continuing with a greater investment of resources.

Project implementation

Then follows the largest scale of activities and the variety of physical work typically needed to implement a project, particularly the manufacture of equipment for it and construction work.

Most companies and public bodies who promote new capital expenditure projects employ contractors and subcontractors from this stage to supply equipment or carry out construction. For internal projects within firms there is the equivalent internal process of placing orders to authorise expenditure on labour and materials.

Different sections of a project can proceed at different speeds in design and consequent stages, but all must come together to test and commission the resulting facility. The project has then reached its productive stage. It should then be meeting the specified objectives of the project.

The problems in meeting objectives vary from project to project. They vary in content and in the extent to which experience can be adapted from previous projects so as to avoid creating new problems. The criteria for appraisal also vary from industry to industry, but common to all projects is the need to achieve a sequence of decisions and activities, as indicated in Figure 1.1.

Figure 1.1 is a model of what may be typical of the sequence of work for one project. Projects are rarely carried out in isolation from others. At the start, alternative projects may be under consideration, and in the appraisal stage they may compete for selection. Those selected are then likely to share design resources with others – which may be otherwise unconnected – because of the potential advantages of sharing expertise and other resources, but they will therefore be in competition with them for the use of these resources through all the subsequent stages in the cycle.

A project is thus likely to be cross-linked with others at every stage shown in Figure 1.1. These links enable people and firms to specialise in a stage or sub-part of the work for many projects. The consequence is often that any one project depends upon the work of several departments or firms each of which is likely to be engaged on a variety of projects for a variety of customers. In all of these organisations there may therefore be conflicts in utilising resources to meet the competing needs of a number of projects, and each promoter investing in a project may have problems in achieving the sequence of activities that best suits his or her interests.

1.5 Project risks

Projects are investments of resources with a distinct increase in the level of investment, as the project passes from concept to implementation. This is demonstrated by the 'typical investment curve' as shown in Figure 1.2. From the graph, deviations from the base investment profile are identified (i.e. risks).

A – Increased income, for example, better than expected sales price/volume, or lower operational costs.
B – Delayed completion: project is completed late, but net revenue is as forecast.
C – Reduced net revenue, for example, worse sales price/volume, or higher operational costs.

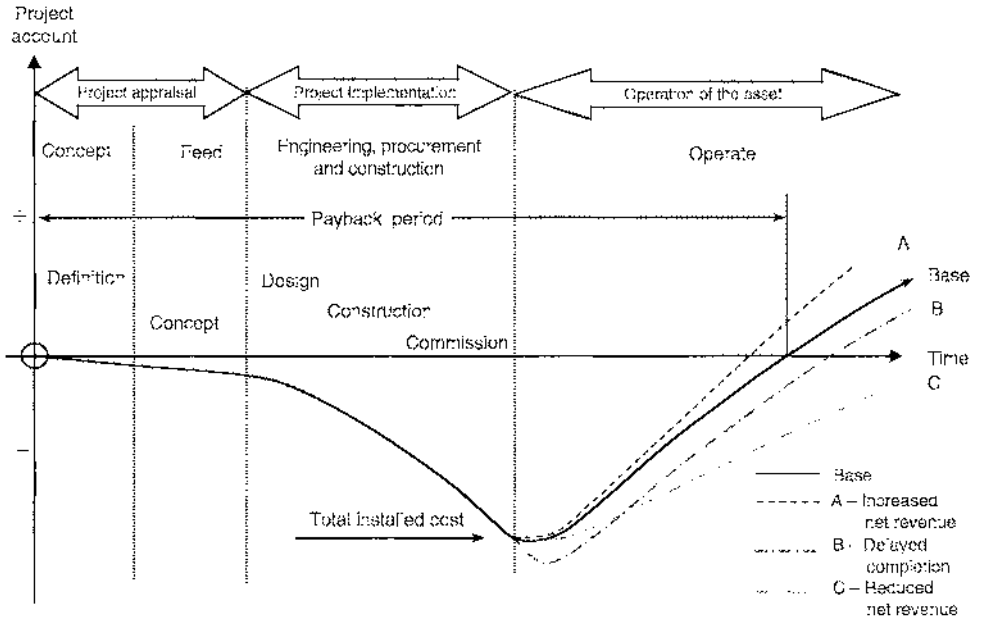

Figure 1.2 Typical investment curve.

All projects are subject to risk and uncertainty. When you purchase goods from a retailer you are able to view them before purchase to ensure that they meet requirements. In other words, you are able to view the finished product prior to making your investment. Unfortunately, this situation is not possible in projects where the promoter is required to make investment prior to receipt of the product. Accordingly, projects are subject to uncertainty and consequent risk during the project delivery process. Such risks may be generated from factors external to the project (e.g. political change, market demand, etc.) or internally from the project activities (e.g. the effect of weather delays or unforeseen conditions). The nature of risk is that it can have both positive and negative effects on the project, that is, there are said to be upside and downside risks.

1.6 Project objectives

It is at the front end of the project cycle that the greatest opportunity exists for influencing the project outcome. This principle is illustrated in Figure 1.3. The curves indicate that it is during the definition and concept stages that the greatest opportunity exists to reduce cost or to add value to the project. This opportunity diminishes as the project passes through sanction to implementation because as more decisions are taken the project becomes more closely defined. Conversely, the costs of introducing change are magnified, and hence the best time to explore options and make changes is at the concept stage and certainly not during implementation.

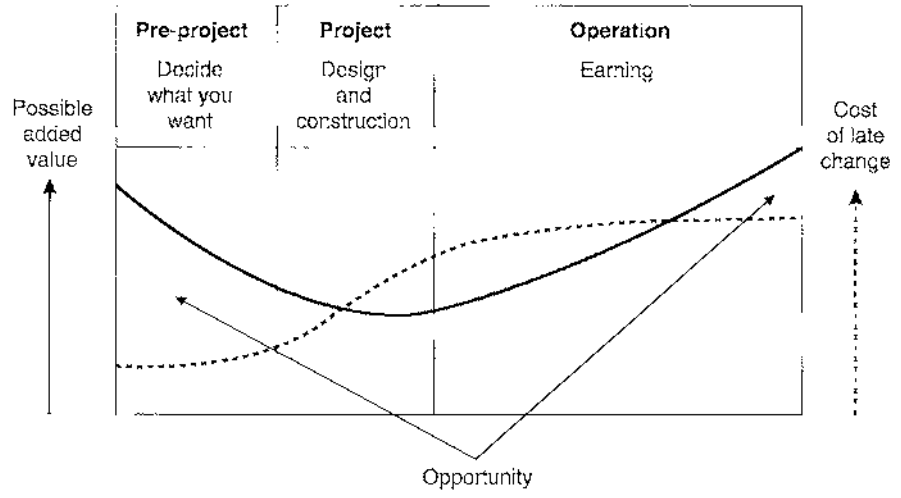

Figure 1.3 Opportunity to add value.

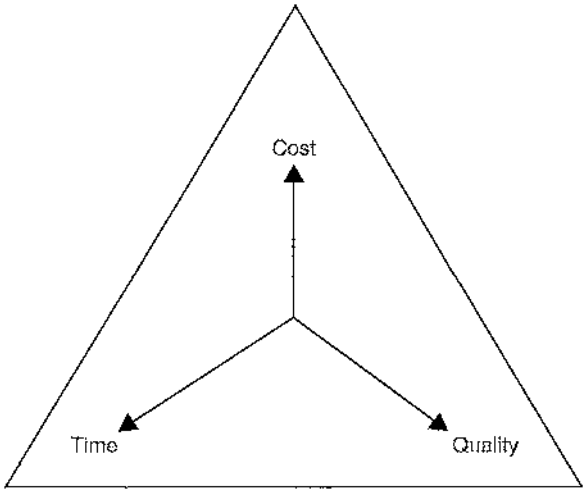

Figure 1.4 The triangle of project objectives (adapted from Barnes and Wearne, 1993).

Projects are implemented to meet the objectives of the promoter and the project stakeholders. The term *stakeholders* is used here to mean those groups or individuals who have a vested interest in the project but may or may not be investors in it. Accordingly, it is important that the project objectives are clearly defined at the outset and the relative importance of the objectives clearly established. Primary objectives are usually measured in terms of time, cost and quality, their interrelationship being shown in Figure 1.4. The use of an equilateral triangle in this context is significant, because, while it may be possible to meet one or two of

the primary objectives, meeting all three is almost impossible. The positioning of the project in relation to the primary objectives is a matter of preference; where early completion is required, time is dominant, as might be the case in the launch of a new product where it is necessary to obtain market penetration first. That is not to say that the project can be completed at any cost nor does it mean that the quality can be compromised, but that time is of the essence. Where minimum cost development is required, such as for a community housing project, quality and time may have to be 'sacrificed'. Where ultimate quality is required, as, for example, in high-technology projects, cost and time may be secondary issues.

The relative importance of each objective must be given careful consideration because decisions throughout the project will be based on the balance between them. Inadequate definition and poor communication of objectives are common causes of failure in projects. Alignment meetings should be held with all key staff to ensure that all decisions are optimised in terms of the project objective.

1.7 Project success

Evidence indicates that success of projects now and in the future may depend upon the following criteria.

Definition of project objectives

The greatest lesson of project management is that the first task is to establish, define and communicate clear objectives for every project.

Risks

To succeed, the promoter's team should then assess the uncertainties of meeting the project objectives. If the risks are not identified, success cannot be achieved. The volume of events taking the team by surprise will be just too great for them to have any chance of meeting the objectives.

Early decisions

Many project successes demonstrate the value of completing much of the design and agreeing on a project execution plan before commitment to the costly work of manufacturing hardware or constructing facilities on a site.

Project planning

The form and amount of planning have to be just right. Not enough and a project is doomed to collapse from the unexpected. Too detailed plans will quickly become out of date and will be ignored.

Time and money

Planning when to do work and estimating what the resources required for it will cost must be considered together, except in emergencies.

Emergencies and urgency

A project is urgent if the value of completing it faster than normal is greater than the extra cost of the faster working. The designation of 'emergency' should be limited to work where the cost is no restraint on using any resources to work as fast as physically possible – for instance, rescue operations to save a life. An emergency is rare.

A committed project team

Dispersed project teams correlate with failure, concentration correlates to success. The committed project team should be located where the main risks have to be managed. Separation of people causes misunderstanding of objectives, communication errors and poor use of expertise and ideas. The people contributing part-time or full-time to a project should feel that they are committed to a team. The team should be assembled in time to assess and plan their work and their system of communications. Consultants, suppliers, contractors and others who are to provide goods and services should likewise be appointed in time to mobilise their resources, train and brief staff and assess and plan their work.

Representation in decisions

Success requires the downstream parties to be involved in deciding how to achieve the objectives of projects and, sometimes, in setting the objectives themselves. Human systems do not work well if the people who make the initial decisions do not involve those who will be affected later.

Communications

The nature of the work for a project changes month by month. So do the communications needed. Their volume and importance of communications can be huge. Many projects have failed because communications were poorly organised. A system of communication needs to be planned and monitored; otherwise information is received too late or goes to the wrong place for decisions, and becomes mere records of little value to control. The records then concentrate on allocation of blame for problems rather than on stimulating decisions to control them. The results of informal communications also need to be known and corrected, as bad news often travels inaccurately.

Promoter and the leader

Every project, large or small, needs a real promoter, a project champion who is committed to its success. Power over the resources needed to deliver a project

must be given to one person who is expected to use it to avoid as well as to manage problems. In the rest of this book we call this person 'the project manager'. It may not be a separate job, depending upon the size and remoteness of the project. In turn, every sub-project should have its project manager with power over the resources it needs.

Delegation of authority

Inadequate delegation of authority has caused the failure of many projects, particularly where decisions have been restrained by requirements of approval by people remote to a problem who have delayed actions and so caused crises, extra costs and loss of respect and confidence in the management. Many projects have failed because authority for parts of a large project was delegated to people who did not have the ability and experience to make the decisions delegated to them. Good delegation requires prior checking that the recipients of authority are equipped to make the required decisions and then monitoring how effectively they make their decisions. This does not mean making their decisions for them.

Changes to responsibilities, project scope and plans

Some crises and the resulting quick changes to plans are unavoidable during many projects. Drive for problem solving is then very valuable, but failure to think through the decisions about problems can cause greater problems and loss of confidence in project leaders.

Control

If the plan for a project is good, the circumstances it assumes materialise and the plan is well communicated, few control decisions and actions are required. Much more is needed if circumstances change or people do not know the plan or understand and accept it. Control is no substitute for planning. It can waste potentially productive time in reporting and explaining events too late to influence them.

Reasons for decisions

In project management, every decision leads to the next one and depends upon the one before. The reasons for decisions have to be understood above, below, before and after so as to guide the subsequent decisions. Without this, divergence from the objectives is almost inevitable – and failure is its other name. Failure to give reasons with decisions and to check that they are accurately understood by their recipients can cause divergent and inconsistent actions. Skill and patience in communication are particularly needed in the rapidly changing relationships typical of the final stages of large projects.

Using past experience

Success is more likely if technical and project experience from previous projects is drawn upon deliberately and from wherever it is available. Perhaps the frequent failure to do this is another consequence of projects appearing to be unique. It is often easier to say 'this one is different' than to take the trouble to draw experience from the ones before. All projects have similarities and differences. The ability to transfer experience forward by making the comparisons is one of the hallmarks of a mature applied science.

Contract strategy

Contract terms should be designed to motivate all parties to try to achieve the objectives of the project and to provide a basis for project management. Contract responsibilities and communications must be clear, and not antagonistic. The terms of contracts should allocate the risks appropriately between customers, suppliers, contractors and subcontractors.

Adapting to external changes

Market conditions, customers' wishes and other circumstances change and technical problems appear as a project proceeds. Project managers have to be adaptable to these changes and yet be prepared to deter the avoidable ones.

Induction, team building and counselling

Success in projects requires people to be brought into a team effectively and rapidly using a deliberate process of induction. Success requires team work to be developed and sustained professionally. It requires people to counsel each other across all levels of the organisation, to review performance, to improve, to move sideways when circumstances require and to respond to difficulties.

Training

Project management demands intelligence, judgement, energy and persistence. Training cannot create these qualities or substitute for them, but it can greatly help people to learn from their own and other people's experience. A completed large project can require retraining of general management to understand and obtain the full benefit from its effect on corporate operations.

Towards perfect projects

The chapters of this book describe the techniques and systems that can be used to apply these lessons of experience. All of them should be considered, but some are chosen as priorities depending upon a situation and its problems.

All improvements cost effort and money. Cost is often given as a reason not to make a change. If so, the organisation should also estimate the cost of not removing a problem.

Further reading

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