CHAPTER 1

INTRODUCTION

LEARNING OUTCOMES

After reading this chapter, you should have an understanding of what this book is about. You should be able to:

- Understand the purpose and importance of cost control
- Identify the nature of cost advice
- Appreciate the nature of construction economics and economic analysis objectives
- Appreciate the main components of design method
- Appreciate the environmental impact of construction projects

1.1 WHAT THIS BOOK IS ABOUT

*Cost Studies of Buildings* is about the understanding and application of costs to building and other structures. One of its aims is to ensure that scarce and limited resources are used to best advantage. It is about ensuring that clients receive the best value for money for the projects that they construct. As buildings have become more complex and clients have become better informed the techniques and tools available have become more extensive. The use of information technology has also provided a new array of possibilities particularly in the case of modelling different design and construct solutions.

The book has been divided into three sections. The first of these provides a context for the material that follows later. It includes a simplified analysis of the construction industry since building costs cannot be studied in a vacuum but need to be considered within the industry to which they are applied. A more detailed study of the industry can be found in *The Construction Industry of Great Britain* by Roger Harvey and Allan Ashworth (Butterworth-Heinemann 1997). It has also been thought appropriate to include a brief history so far of the subject of building economics. The subject material in general is provided under a number of different titles and descriptors. It has variously been described as building economics, cost planning (although this definition now means something completely different) and cost control.
The second section is about the different sorts of cost information that are required to undertake an effective study of building costs. These include the traditional sources of cost information such as material prices and measured rates for different kinds of construction work as well as the more applicable cost analyses. Cost information can also come in many guises such as indices of cost, taxation and sources of funding and design data. While the latter is not strictly cost information, the design of a project has a particular influence on costs and the economics of design are influenced by a large number of factors. The importance of research ends this section. Without this, the subject remains sterile and innovation in building costs does not take place. Cost innovation comes from many directions including designers, constructors and manufacturers.

The third section is concerned with the practice of cost studies. These use a range of techniques that can be applied to each individual project in turn. A selection of these techniques will be adopted for all projects depending upon the aims and objectives sought by the client. Even in the simplest case some form of early price estimate will be required but this on its own is insufficient for modern-day clients. The practices being used are constantly being extended and improved as Chapter 2 will identify. These include a range of cost and value techniques from the inception through to the in-use phase. The whole aspect of the study of building costs has shifted the emphasis towards value for money. This shift has included the following:

- Development appraisal
- Elemental analysis
- Application of cost planning
- Introduction of cost limits and allowances
- Educational research and practice
- Alternative procurement systems
- Cost–value reductions
- Whole-life costing
- Value engineering
- Facilities management
- Risk analysis
- The future directions of cost studies of buildings

Some will attempt to argue that a few of these techniques merely limit expenditure and apply a range of cost control practices, i.e. they are restricted to cost reduction mechanisms. In practice they do much more through refocusing the design and construction teams by adding value to the project.

1.2 THE PURPOSE OF COST CONTROL

The purpose of cost control can be generally identified as follows:

- To limit the client’s expenditure to within the amount agreed. In simple terms this means that the tender sum and final account should approximately equate with the budget estimate.
To achieve a balanced design expenditure between the various elements of the buildings.

To provide the client with a value-for-money project. This will probably necessitate the consideration of a total-cost approach.

The client may stipulate the maximum initial cost expenditure, or provide a detailed brief to the design team who will then determine the cost. Most schemes are a combination of these two extremes.

1.3 THE IMPORTANCE OF COST CONTROL

There has in recent years been a great need for an understanding of construction economics and cost control, particularly during the design stage of projects. The importance of this is due largely to the following:

- The increased pace in society in general has resulted in clients being less likely to tolerate delays caused by redesigning buildings when tenders are too high.
- The client’s requirements today are more complex than those of their Victorian counterparts. A more effective system of control is therefore desirable from inception up to the completion of the final account, and thereafter during costs-in-use.
- The clients of the industry often represent large organisations and financial institutions. This is a result of takeovers, mergers and some public ownership. Denationalisation has often meant that these large organisations remain intact as a single entity. There has thus been an increased emphasis on accountability in both the public and the private sectors of industry. The efficiency of these organisations at construction work is only as good as their advisers.
- There has been a trend towards modern designs and new techniques, materials and methods of construction. The designer is able to choose from a far wider range of products and this has produced variety in construction. The traditional methods of estimating are unable to cope in these circumstances to achieve value for money and more balanced designs.
- Several major schemes in the UK and abroad in construction and other industries have received adverse publicity on estimated costs. Even after allowing for inflationary factors, the existing estimating procedures have been very inadequate (see Chapter 14). It is not a valid diversion to suggest that projects in other industries such as the Nimrod Early Warning System, Concorde or space exploration have produced considerably more inaccurate estimates than those in the construction industry.
- Contractors’ profit margins have in real terms been reduced considerably during the past decade. This has resulted in their greater cost-consciousness in an attempt to redress possible losses.
- There has, in general, been a move towards the elimination of waste, and a greater emphasis on the use of the world’s scarce resources. This has necessitated a desire for improved methods of forecasting and control of costs.
There is a general trend towards greater cost-effectiveness, and thus a need to examine construction costs not solely in the context of initial costs but in terms of whole-life costs, or total-cost appraisal.

World recession has generally produced a shortage of funds for capital purposes and construction in general. This has been coupled with high inflation and interest charges, resulting in the costs of construction soaring to high levels. Although the relative costs compared with other commodities may be similar, the apparent high costs have resulted in greater caution, particularly on the part of clients.

1.4 COST, PRICE AND VALUE

The terms cost, price and value will represent different interpretations to different people. Their particular meaning generally lies in the context in which they are being used. It must also be remembered that much of the terminology used in the construction industry has a special interpretation appropriate only to this industry. Cost, to the building contractor, represents all those items included under the heading of his expenditure. His price is the amount charged for the work he carries out, and when this is received it becomes his income. The difference between the two is his profit. Cost is therefore reasonably clearly defined within this context. It relates largely to manufacture, whereas price relates to selling. The term ‘cost price’ really means selling at cost. The price, however, that the building contractor charges the building owner for doing the work is to the latter his building costs. The Building Cost Information Service (BCIS) was designed and developed on the basis of the building owner’s costs. These are in reality the tender price from building contractors. A tender price index therefore attempts to measure the building contractor’s prices (the building owner’s costs) whereas a building cost index measures the building contractor’s costs. Although there is some relationship between the two, they are not identically correlated.

It is not surprising, therefore, to realise how easy it can be to confuse these two terms if used incorrectly. To adapt the famous quotation, ‘one person’s (builder’s) price increase is another person’s (building owner’s) cost increase’.

Value is a much more subjective term than either price or cost. In the economic theory of value, an object must be scarce relative to demand to have a value. Where there is an abundance of a particular object and only a limited demand for it, then, using the economic criteria, it has little or no value attributed to it. Value constitutes a measure, therefore, of the relationship between supply and demand. An increase in the value of an object can therefore be obtained through either an increase in demand or a decrease in supply.

Aristotle identified seven classes of value that are still relevant to our modern society. These classifications of value can be summarised as: economic, moral, aesthetic, social, political, religious and judicial. These bear some resemblance to the way in which we identify building life as shown in Table 17.2. Economic value may be seen as the more objective consideration, since it is measurable in terms of
money. The remainder are seen as being more subjective. Maximum value is assumed to be found when a required service or function is attained and when the cost of providing that service or function is at a minimum. Value in this context can be measured objectively, but any solution found through such a procedure risks sub-optimisation. Any increase above the required level of either service or function, for a small extra cost, would often be perceived by clients as better value. A more meaningful approach when applied to the built environment considers the following four components that when aggregated combine to provide a clearer picture of value:

- **Use value.** This is the benefit attached to the function for which the item is designed
- **Esteem value.** This attribute measures the attractiveness or aesthetics of the item
- **Cost value.** This represents the costs to produce or manufacture the item and to maintain it over its period of possession or life. This relates very much to the issues surrounding whole-life costing (see Chapters 17 and 18)
- **Exchange value.** This is the worth of an item as perceived by others who are primarily interested in its acquisition.

### 1.5 VALUE FOR MONEY

Value is a comparative term expressing the worth of an item or commodity, usually in the context of other similar or comparable items. Cheapness in itself is of no virtue. It is well worthwhile to pay a little more if the result in gain in value exceeds the extra costs involved. For example, it has been shown that sometimes to spend an extra sum initially on construction costs can have the effect of reducing recurring or future costs and hence the overall sum (or whole-life cost) spent on an investment. This may, of course, not always be the case since high initial costs may require high recurring costs for the item’s upkeep or maintenance.

Value for money is an easy concept to understand but a difficult one to explain. It is in part subjective in its assessment in that different individuals assess different things in different ways. The appearance of buildings or engineering structures will always largely be subjective, even though a framework of rules may be devised for its evaluation. However, the opinions or judgements of others cannot be entirely disregarded. Designers have developed some rules or guidelines for the assessment or judgement of aesthetics based upon shape, form, colour, proportion, etc. The assessment of aesthetic design is difficult, since personal choice and taste are factors that need to be considered.

The engineering aspects of design, such as function or performance, are in part able to be judged against more objective criteria. On the face of it, these appear to be easier to assess and to make comparisons in terms of value for money. Criteria are frequently provided to designers in a client’s brief and can be realistically compared with other similar structures. For example, the judgement of the spatial layout represents the adequacy of the internal space arrangement and can be related
to the extent to which it facilitates the desired functions to be performed in the
building. The structural components and the environmental comforts that are
created can be judged in a similar manner, often using simple numerical data and
analysis.

The third factor to consider is that of cost and value. The obvious approach is to
put all the measurable components on one side of the equation in the form of cost,
and to set these against the subjective and objective value judgements in an attempt
to determine value for money. The determination of the best solution will never be
an exact science, since it will always rely upon judgements set against a client’s own
value judgements that may be expressed as aims and objectives or outcomes. A part
of value for money is quantitative in its analysis; other aspects will always remain
qualitative by definition. Value for money is the start of the process of added value.
It is the principle of doing more with less, a feature that has become common in all
walks of life.

A major theme at the start of the 21st century remains value for money, now
more appropriately described and defined as added value. It was John Ruskin
(1819–1900) who said, ‘It is not the cheaper things in life that we want to possess,
but the expensive things that cost less.’ There are now many recent reports on
the construction industry that have indicated that clients in the future will insist
upon increased value for the money that is expended on their capital projects.
The principle involves reducing the relative costs of construction by designing,
procuring and constructing the work in a different way than at the present time.
The construction industry was, of course, responding to this challenge throughout
the latter part of the twentieth century, and with some success. It involves doing
more for less by removing unnecessary costs. It aims to meet the perceived needs
associated with efficiency, effectiveness and economy.

1.5.1 Efficiency, effectiveness and economy

The successful accomplishment of a task reflects effectiveness, while performing
tasks to produce the best outcome at the lowest cost from the same resources
used is efficiency. Effectiveness is doing the right things, efficiency is doing
these things better. The best performance maximises both effectiveness and
efficiency.

A building decision is effective from the point of view of the client where this
achieves positive outcomes. These may be outcomes in respect of financial measures
that a developer may expect, or they may be outcomes that are socially effective and
may be measured using techniques such as cost–benefit analysis. In a broad sense
they represent good decisions.

Efficiency results in maximising the effectiveness of a project. For example,
if a building design enhances productivity whilst costing no more in resources than
competing designs, it is described as an efficient user of these resources. Where
a building project offers the same level of performance as its alternatives and costs
less then this too is an efficient solution.
In order to be effective the project must meet the objectives set by the client. Where these objectives can be achieved for less or achieve more than what was expected for the same budget then an efficient solution is achieved. Sometimes the terms 'economically efficient' and 'cost-effectiveness' are used loosely to describe the same thing.

Economic optimisation is the process that is used to determine the most economic in terms of both efficiency and effectiveness. In the real world it is a goal that is rarely achievable, since possible solutions that might achieve better goals against this objective may be unknown and therefore undetected. Optimum solutions are therefore restricted to current knowledge scenarios. Optimum solutions also militate against the theory of continuous improvement that is a required part of added value expectations and its general philosophy.

1.5.2 Best value

The discernible shift that has occurred in the focus of activities from cost to value is very much embedded in the Best Value movement. Best value is a concept that has come out of the Local Government Act (1999), which sets out the requirements that are expected. The key phrase in the Act is: ‘A Best Value authority must make arrangements to secure continuous improvement in the way in which its functions are exercised, having regard to a combination of economy, efficiency and effectiveness.’ The concept of best value applies equally well in the private as in the public sector. None of us wants to possess the cheaper things in life, but to possess ‘the expensive things that cost less’. Best value aims to achieve a cost-effective service, ensuring competitiveness and keeping up with the best that others have to offer. It embraces a cyclical review process with regular monitoring as an essential part of its ethos.

Best value extends the concepts of value money that have been identified for a long time within both construction and property. Rethinking Construction, for example, defines value in terms of zero defects, delivery on time, to budget and with a maximum elimination of waste. In order to show that best value and added value are being achieved, it becomes essential to benchmark performance including costs. It is also necessary to benchmark the overall cost of the scheme so that improved performance in the design can be assessed against its cost. The sharing of information underpins the whole best practice process. Even the leaders in an industry need to benchmark against their competitors in order to maintain that leading edge. Whilst the aspiration of best value is both admirable and essential, its demonstration in practice presents the challenge.

The best value concept for local authorities is being managed for the Department Communities and Local Government by the Audit Commission. It is a challenging performance framework placed on local authorities by central government and, since April 2000, all local authorities in England and Wales have had a duty to plan to provide their services under the principles of best value. Each service review must show that the local authorities have applied the four ‘Cs’ of best value to the service, and show that it is:
Challenging: Why and how the service is provided

Comparing the performance with others, including non-local government providers

Competing: The authority must show that it has embraced the principles of fair competition in deciding who should deliver the service

Consulting local service users and residents on their expectations about the service

Local authorities are required to show that they are continuously improving the way in which their services are delivered.

The Audit Commission has set up a new inspection service to guide the work of best value. In common with other forms of inspection services and benchmarking, best value seeks out best practices and uses this to help all local authorities to improve their general levels of performance. Best practices today are unlikely to be best practices tomorrow, since the achievement of improvements in quality is always a journey and never a destination. The enhancement of quality remains the long-term goal. Best value inspectors use a simple framework of six questions to make sure that they collect the right information and evidence to support their judgements:

- Are the authority’s aims clear and challenging?
- Does the service meet its aims?
- How does its performance compare?
- Does the best value review (BVR) drive improvement?
- How good is the improvement plan?
- Will the authority deliver the improvements?

Best value is a concept that is important not only to the public sector but also within private sector organisations, however it is achieved.

1.6 COST ADVICE

Throughout the development cycle the quantity surveyor will be called on to advise the client on matters of cost. This cost advice will be necessary regardless of the method used for contractor selection or tendering purposes. The advice is particularly crucial at the early stages of project inception. It is at this time that major decisions, often affecting the size and quality of the works, are determined, if only in outline form. It is important therefore that the cost advice given be as reliable as possible, so that clients can proceed with the greatest amount of confidence. Quantity surveyors are widely recognised within the construction industry as the most appropriate cost advisers. Their skills in the measurement and valuation of construction work are without equal.

The type of cost advice required will vary depending on the individual circumstances and the nature of the design and specification information available. A designer who is either unable or unwilling to provide quantifiable and qualitative
information must therefore expect that the design cost advice will, by necessity, be vague. If we are unable to tell contractors what we require them to construct, then we should not expect them to price such work. Surveyors must also realise the importance of providing realistic cost advice, which will contribute to the overall success of the project. In this context they must become more familiar with design method and construction organisation and management.

The types of cost advice which may be required at the different stages of the development cycle may include a combination of the following:

- Budget estimating based on a client’s brief
- Cost advice on different tendering and contractual arrangements
- Pre-tender price estimating
- Comparative costs of alternative design solutions
- Elemental target costs for cost planning
- Whole-life cost planning
- Tender analysis, reconciliation and recommendation
- Interim payments and financial statements
- Final accounting
- Cost analysis of accepted tenders
- Costs-in-use
- Taxation and insurance considerations

1.7 CONTRACTUAL ARRANGEMENTS AND THEIR EFFECTS ON COSTS

The needs of the client in connection with a proposed construction project are unique. A majority of projects are of a bespoke design even where ideas may be copied from other projects or standard components are used. Even in the case of an ‘off-the-shelf’ project the site characteristics, and most likely the weather conditions under which the project is constructed, will be unique to the project. This means that achieving the right price for the project within the right timescale is a challenge.

Many of the clients of the construction industry are not regular purchasers of projects. A successful outcome is achievable only where the complexity of the processes used is carefully understood and dealt with appropriately. Such clients, through their networks, will paint a glowing picture of the industry where a project has gone well in their eyes. They will thus act as ambassadors for the industry in encouraging associated clients to modernise their premises or to build new premises.

The establishment of a clear procurement strategy is the key to a successful outcome. This strategy will assist those who are involved in planning and co-ordinating projects to prioritise key outcomes as well as reflecting on risk and establishing how the process will be managed and controlled. Six key steps have been identified by the Strategic Forum Accelerating Change report. These are as follows:
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- **Statement of business needs.** Priorities, outcomes, stakeholder and constraints
- **Business case.** Encompassing all business requirements
- **Strategic brief.** Expressed in client’s terminology and an absence of industry jargon
- **Selection of the team.** This may incorporate the early selection of the contractor and other specialist firms
- **Delivery of the business solution.** Clearly focused upon by the client and the team
- **Capture learning.** Confirm benefits and inform future projects

The execution of construction work on site necessitates the awarding of a contract to a constructor. The promoter or client has many different options available for this purpose. A successful contractual arrangement, however, will generally require the adoption of some recognised procedures. The construction industry is constantly examining new ways of contractor selection to combat bad press reports on construction time, cost and performance. Methods used in other countries were supposed to reduce the contract period. Further investigation and research should enable performance generally to be improved. The quantity surveyor’s skills are aimed at producing more economic designs and solutions to construction work on site. For a descriptive treatment of the various methods available, students should refer to *Contractual Procedures in the Construction Industry* by Allan Ashworth (Pearson Prentice Hall 2006).

In addition to other objectives, clients prefer to pay as little as possible for the construction projects. They also wish to know in advance, wherever this is possible, the expected price they will be required to pay. Contracts can be broadly classified as either measurement or cost reimbursement. The former type provides for a reasonably accurate cost prediction, the latter does not. However, if the cost reimbursement contracts can be shown to be less expensive then clients will often be prepared to forgo the specific price prediction. Factors such as the cost–risk element, which is greater to the contractor in the measurement contract, must be balanced with the cost control capabilities which are recognised as being weak with cost reimbursement contracts. The following are generally held opinions based on rule-of-thumb guidelines alone:

- In the absence of any form of competition, tender prices are likely to be higher than where several firms may be seeking the contract.
- Negotiated tenders, under normal conditions, are typically 5% higher than a comparable selective tender.
- Open tendering should achieve the lowest possible tender sum for a project.
- Unorthodox or unusual methods of tendering and contractual arrangements generally incur higher costs.
- There is an optimum contract period in terms of cost; where this is varied tender prices will generally increase.
- Fixed price tenders do not necessarily mean lower final accounts. Where they over-anticipate inflation they will produce higher final accounts than the comparable fluctuating price tender.
The economics of the contractual arrangements need to be measured in terms of the total cost to client, inclusive of professional fees associated with cost. It must be remembered, as in other types of evaluation, that economics is only one factor to consider. Open-ended contracts which may produce the lowest final accounts can cause immense anxieties for a client, who may prefer to pay for peace of mind. It is in reality very difficult to make realistic comparisons, even where it is possible to examine two similar projects being constructed on different contractual bases.

1.7.1 Duty of care

Reasonable care must be exercised during the preparation of estimates, tenders or quotations. A building owner cannot be held responsible or liable for the mistakes in tenders prepared by a building contractor. They can, of course, to some extent protect themselves against the unfortunate effects of these errors, by assessing a tender against an approximate estimate or the tenders from other contractors. They will not, knowing that a tenderer’s price is dubiously low, want to enter into a contract with that firm, for fear of the contract being uncompleted or difficult to execute.

Professional surveyors present themselves as being qualified to do the work entrusted to them. If they do not possess the level of skill or experience which is usual in the profession, or if they neglect to use the skill which they in fact possess, they will be guilty of negligence. Although surveyors may be sued for negligence under their contract of employment with the building owner or under common law in tort, the owner would first need to prove the following:

- That the surveyor owed a duty of care. If the surveyor was receiving a fee for services then the point would be established. Even in circumstances where a fee was not charged, this would not necessarily remove the duty of care.
- That the surveyor’s error was carelessly made, and performance of duty was done in a reasonable manner. It would need to be shown that under similar circumstances other surveyors were able to provide more accurate forecasts of the future prices for a proposed project.
- In order to recover damages for negligence, it is necessary then to prove the amount of damages suffered.

1.8 CONSTRUCTION ECONOMICS

Construction economics consists of the application of the techniques and expertise of economics to construction projects. Economics in general is about the choice of the way in which scarce resources are and ought to be allocated between all their possible uses. Construction economics is a small part of a much larger subject of environmental economics. This is concerned with the study of man’s needs in connection with shelter and the suitable and appropriate conditions in which to live. It seeks to ensure the efficient use of resources available to the industry, and to
increase the rate of growth of construction work in the most efficient manner. It includes a study of the following.

**A client’s requirements** This involves a study of the client’s wants and needs, and ensuring that the design of the project is kept within the available funds to be provided by the client. The client’s fundamental needs can be summarised as follows: satisfaction that the building meets their needs, that it is available for occupation on the specified date for completion, that the final account closely resembles the estimate and that the construction project can be maintained at reasonable cost.

**The possible effects on the surrounding areas if the development is carried out** This considers the wider aspects associated with planning and the general amenities affected by proposed new construction projects.

**The relationship of space and shape** This evaluates the cost implications of the design variables, and considers those aspects of a particular design and their effects on cost. It does not seek to limit the designer’s skill or the aesthetic appearance of the project, but merely to inform the designer and the client of the influence of their design on the overall cost.

**The assessment of the initial cost** This factor seeks to establish an initial estimate that is sufficiently accurate for advice purposes and can be used for comparison purposes throughout the building process.

**The reasons for, and methods of, controlling costs** One of the client’s main requirements in respect of any construction project is the assessment of its expected cost. The methods used for controlling the costs will vary, depending on the type of project and the nature of the client. The methods adopted should be reasonably accurate but flexible enough to suit the individual client’s requirements.

**The estimation of the life of buildings and materials** The emphasis on the initial construction costs has moved to consider the whole-life costs of a project. The spending of a little more initially may result in a considerable saving over the life of the building. However, the estimation of building material life, interest rates and the economic life of a project can be difficult in practice. The influence of taxation can have a substantial effect on whole-life costs.

Consideration must also be given to the wider aspects of the subject of construction economics in respect of the industry in general. The economic aspects of the following are worthy of note:

- The role of the surveyors, architects, engineers and builders employed in the industry
- The division of the industry between the design and construction processes
The size of the industry, its relationship to other industries and the national economy

The types of development undertaken

The types and sizes of construction firms, and the availability of specialist contractors

The variations in building costs and factors that influence these variations – market conditions, regional location etc.

The construction industry has characteristics which separate it from other industries. These characteristics can be classified as follows:

- The physical nature of the product
- The structure of the industry
- The organisation of the construction process
- The method of price determination

The final product is often large and expensive and may be required over a wide geographical area. Buildings and other structures are for the most part specially made to the requirements of each individual customer, although there is scope for

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**Fig. 1.1** Construction economics objectives

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some speculative work, particularly in housing. The nature of the product also means that each contract often represents a large proportion of the work of a single contractor in any year, causing substantial discontinuity to the production functions.

Project cost control is the application of economic principles to the construction project. It examines not only the costs appropriate to a specific project, but also the factors and influences of the determinants of this cost (Figure 1.1).

1.9 ECONOMIC ANALYSIS OBJECTIVES

The primary objective of economic analysis is to secure cost-effectiveness for the client. In order that this can be achieved, it is necessary both to identify and to evaluate the probable economic outcome of a proposed construction project. The analysis will be required from the viewpoint of the owner of the project for his competing proposals. The analysis may be evaluated in the following terms:

- To achieve maximum profitability from the project concerned
- To minimise construction costs within the criteria set for design, quality and space
- To maximise any social benefits
- To minimise risk and uncertainty
- To maximise safety, quality and public image

1.9.1 Procedure to be followed

Economic analysis comprises four processes:

1. Preparation, which includes understanding the project, defining the client’s objectives and collecting the appropriate data
2. Analysis, which requires an interpretation of the available data and the formulation of alternative solutions
3. Evaluation, which is a combination of the assessment of the suggested alternatives and the identification of the optimum solution
4. Decision-making, which involves choosing to proceed with the course of action now identified

These processes are now briefly discussed.

Understanding the project

Prior to economic analysis, the aims of the promoter of the project should be clearly understood.

Defining the objectives

The failure to identify clearly the client’s needs is a main source of client dissatisfaction. The objectives must be clearly stated and understood, and be compatible with each other. These may include:

- To provide an industrial building of 30,000 m² required for a specific manufacturing process
- To have the building ready for occupation in three years’ time
To have an initial cost not exceeding £20m and to provide for whole-life cost savings in the immediate ten-year period.

The client’s objectives and criteria must be specified and defined quantitatively. It will be necessary to define more precisely the extent of the whole-life cost measures to be incorporated.

**Collecting data**  A review of all known information regarding the type of project to be constructed should be collected. Data regarding the nature of the construction site and the availability of facilities should be obtained.

**Analysis of data**  This is the process of converting the developed data into something meaningful and useful which is capable of achieving the desired objectives. Some of this information can be handled by the computer in order to generate as much information as possible.

**Interpretation of results**  This will occur on completion of the analysis and will determine both the feasibility and the viability of the project under examination. The results should be well organised and comprehensive in order that they may be properly utilised in the evaluation phase.

**Formulation of alternative solutions**  Different solutions will be available which may lead to the same objectives. These alternatives need to be fully explored in terms of the client’s evolving needs.

**Evaluation of alternatives**  The criteria selected for comparison should enable the optimum solution to be selected. The correct balance between initial costs and the necessity to reduce future costs should consider all criteria.

**Identification of correct project**  If management is to be able to make the right decisions, it must do so on the basis of all the known information and a correct economic analysis as outlined above.

1.10 DESIGN METHOD

Efficient cost advice from the quantity surveyor depends on at least some understanding on his or her part of the design method used by architects or engineers. Some effort must therefore be made to appreciate what the designer is attempting to achieve, and the method used during this process.

The design of a construction project is a combination of three facets (see Figure 1.2).

1.10.1 Function

Function includes an understanding of the way in which the project will eventually be used. It may also be necessary to consider the ways in which this use may change...
over the lifespan of the project, and how it may be adapted to suit these changes. If the project does not serve its function properly, then it is likely that it will prove to be an irritation to its users or owners. In this case it may need to be quickly altered or perhaps even abandoned in favour of an alternative structure. In the extreme case projects which are non-functional may prove to be nothing more than a designer’s folly.

1.10.2 Technology
A good designer should be fully conversant with the materials and methods of construction which may be available. Technological aspects also take into account the manufacture and assembly of the various components. The designer needs to be aware of the resources of men, machines, materials and money which will be required for the design, and that the required technology is already available. The designer must take note of the buildability aspects which will affect performance, function and cost. A truly good design, one presupposes, is one that is in the correct sense well built. Sound building is an essential ingredient of good architecture or engineering. As well as understanding building construction the designer should also be familiar with production technology.

1.10.3 Aesthetics
Aesthetics is largely a combination of the building purpose itself together with the location of the project within the built environment. The vocabulary of visual aesthetics includes unit, texture, form, colour, proportion, balance, symmetry, character etc. Although aesthetics are to some extent value judgements, and therefore highly subjective, there are some readily defined rules which can only be ignored at one’s peril.

Excellence in building and construction is therefore attained only where appearance, soundness of construction and usefulness have been developed together in a fully integrated manner. The quantity surveyor will wish to add to these criteria the importance of cost and value. In today’s economy, excellence in design must be
achieved at a reasonable level of cost, both in respect of initial costs and also during use. The provision of cost advice on a quantity basis can fairly readily be provided using single-price methods of estimating or by a form of analysis. New technological solutions can also be evaluated by the latter method. The costing of the qualitative aspects of the design is not so easy and relies heavily on experience and opinion and value judgements. However, since these aspects are generally fully integrated it is almost impossible to consider one without the others. Furthermore, it is necessary that such cost advice be provided throughout the various stages of both the design and construction process, and also once the project is in use.

Design methods also need to work within the general constraints imposed by the technical, legal, functional and economic framework. The technical constraints impose limitations in respect of the characteristics of materials available, the skill and craftsmanship of labour, the structural form required, the necessity of integrating engineering services into the project, and the capability of the constructional processes which might be used. For example, it may be possible to design large building units which 'clip' together, and while the theory may be sound, the idea may be limited due to access and location of the site which allow only the delivery of small components. Designers may assume that errors on site can be reduced almost to nothing. The practical aspects of construction operations today indicate that this is incorrect, and where a design relies on this assumption it will fail. The technical constraints must also take into account the general requirements of buildability. This may result in modifications to the design to ensure good building method. Buildability must not be confused with convenience building, which is not a criterion of good building design.

Construction works must also be designed within the legal framework appropriate to the country concerned. While it is possible to design a building which will exclude these requirements, in practice this will not be allowed. Within the UK, and this is common in most countries, some form of legal constraint is necessary to protect both adjoining owners and third parties at large. These legal restrictions include easements, restrictive covenants, building regulations, planning laws, ownership considerations, safety and health acts, and impositions required by the form of contract. Restrictive covenants impose conditions which govern the use of land, while an easement relates to the rights of land usage which include the right to light, right of support, right of way and right to drainage. Functional constraints are imposed by the client, and may restrict designers in their work. For example, the designer must be fully aware of the intentions of the user. This is why a purpose-built project is likely to be more satisfactory than one which was constructed by a developer for speculative reasons or 'off the peg'. The function will also impose restrictions on the aesthetics which the designer may consider to be most appropriate. The designer needs to consider both anthropometrics (which relates to the measurement of the human body) and ergonomics (which introduces the idea that fatigue should be minimised). The designer will need to consider the relationship between the different room or location uses by means of a circulation diagram. This will allow the correct positions of the various rooms to be identified. The function of the building will also dictate to some extent the needs for the
provision of environmental services, and the comfort criteria which may be required. The designer must take all of these into account when formulating a design solution. A final consideration of cost or economics in the solution will also constrain designers in their work. They will need to be conscious all the time that, however grand their ideas may be for the project, these must come within the client’s overall budget. A designer may be able to persuade a client to adopt some particular favourite part of the design, but in general the cost constraints will be imposed in line with the approximate estimate which was delivered to the client at inception. The purpose of economic constraints is not to provide a cheap building, but to create an acceptable solution within the funding availability of the client.

The designer’s first meeting with a client will generally identify the building type, its size, the funds available and the location of the site. The designer’s first duty will often be to visit the site, and to attempt to visualise at this stage some idea of the project on the site. Aspect, horizontal and vertical forms, size, shape and position will need to be considered. This is a difficult task and requires a vivid imagination on the part of the designer. The designer must attempt to utilise the full benefits of the site to the best advantage. ‘Best’ in this context will often be based on rule-of-thumb considerations alone, with little attention paid to its verification in practice. Clients often require their projects to fulfil a function that is related to spatial factors such as the numbers in a school, since these often determine some form of building cost criteria. The priorities for space should be ranked so that they can be given their due importance in solving the design problem in accordance with the client’s requirements. Priorities will also exist in the choice of materials and methods of construction. The choice is often difficult to make, but a scarcity of financial resources makes it inevitable. These decisions are at the centre of good cost control.

The design approach will also vary depending on the nature of the designer. The mention of a proposed scheme such as a church or house or office block to a designer may immediately create an architectural form in mind. This approach, although often denied by architects, is known as designing from the outside in. It is a Wild West approach, where the façade is really all that matters. After all, this is often the only part of a building that is seen by the majority of the public and possible building clients. Before attempting to be too critical of this method, let us remember that when ‘house-hunting’ a poor elevational appearance may deter one from further viewing. The alternative method, which is generally recognised as being more satisfactory, is to design from the inside out. Choose the correct spatial arrangements, and then decide on the elevational treatment that is the most appropriate. This need not imply that the external appearance does not matter, but seeks to select priorities in the design.

There will often be many different ways in which to organise the spatial arrangements. The available alternatives will influence the cost–shape factor. It is not until this stage has been reached in the design process that some form of realistic cost target can be applied for elemental analysis purposes. The elemental cost targets cannot be fixed until these major decisions have been finalised. Once the spatial
arrangements have been accepted then some attempt can be made to satisfy the form of
the structure as may originally have been envisaged. The choice of constructional
methods and materials will greatly influence the final solution. This will involve
selecting the correct specification to fulfil the purpose of the scheme. The role of
the quantity surveyor in identifying the costs of the various available choices is
invaluable to the designer.

1.11 BUILDING ECONOMIC THEORIES

The study of economics applied to construction projects has resulted in the
formation of some building economic theories. However, due largely to the infancy
of this academic discipline, more theories have yet to emerge. The theories provide
a broad indication of the cost implications of building design. Perhaps the best
known of these theories is the wall-to-floor ratio, where the implication is that the
lower this ratio, the less expensive will be the cost of building. Many such theories
can be expressed in a mathematical equation form. Further research should enable
us to achieve a better understanding of the determinants of building cost. At the
moment only a small amount of analytical work has been carried out, and therefore
our advice is often based on opinion and assumption, albeit of an expert nature.
Other theories which have emerged are as follows.

Plan shape index = \frac{g + \sqrt{(g^2 - 16r)}}{g - \sqrt{(g^2 - 16r)}}

where \(g\) is the sum of the perimeters of each floor divided by the number of floors
and \(r\) is the gross floor area divided by the number of floors. This is a development
of the length/breadth index devised by Mr D. Banks of the then Polytechnic of the
South Bank. It aims to measure the plan shape efficiency of a building.

Optimum envelope area = n\sqrt{N} = \frac{x\sqrt{f}}{2S}

where \(N\) is the optimum number of storeys, \(x\) is the roof unit cost divided by
the wall unit cost, \(f\) is the total floor area (m\(^2\)) and \(S\) is the storey height (m).
The envelope of a building comprises the external walling area and the roof.
This theory, using the above formula, aims to select the appropriate number of
storeys for a building based on roof and wall costs.

In each of the above theories only a few of the major elements are taken into
account in measuring building economy. Other theories have also been developed,
and some of these are explained more fully in Chapter 5.

1.12 ENVIRONMENTAL IMPACT OF THE CONSTRUCTION PROJECT

The impact of the construction industry on the environment is substantial. During
the extraction and manufacture of construction materials, their transportation, the
process of construction and the use of buildings, large quantities of energy are used. Major contributions are made to the overall production of carbon dioxide which exacerbates the 'greenhouse' effect. The environmental impact is global but, during the construction process, communities and individuals are affected.

Society is becoming increasingly concerned with the effect of human activity on the environment. In recent years there has been greater pressure on clients to state all the likely direct and indirect effects of their projects on the life and amenities of surrounding areas. It has been the practice to supply environmental impact assessments with planning applications for major projects. The assessment requires a statement of the impact of the project on the surrounding area. It should also include details of work which will limit the impact, e.g. soundproofing in the case of a noisy transportation system. To involve the public more closely the assessment statement should be jargon-free. A further requirement is that promoters should consider the detailed impact of their project early in the planning process and undertake wide consultations involving the public and environmental groups. Despite the requirements specified by the directive, there is concern that there is a lack of definition regarding the scope of the assessments and the level of detail required. Assessments frequently tend not to look beyond the confines of the project concerned.

The concept of a green building is an elusive one. The definition is broad and being green in a professional sense may merely come down to a change in attitude. Most buildings in the UK are designed to cope with the deficiencies of a light loose structure, designed to meet the Building Regulations thermal transmittance standards and no more. Given that about 56% of energy consumed, both nationally and internationally, is used in buildings, designers have opportunities and responsibilities to reduce global energy demand. There is a need to make substantial savings in the way that energy is used in buildings, but there is also a need to pay attention to the energy used in the manufacture and fixing in place of a building's components and materials. For a new building this can be as high as five times the amount of energy that the occupants will use in the first year.

In the 1950s and 1960s building maintenance and running costs were largely ignored at the design stage of new projects. Today the capital energy costs which are expended to produce the building materials and to transport them and fix them in place are often ignored in our so-called energy-efficient designs. In any given year the energy requirements to produce one year’s supply of building materials is a small but significant proportion (5%–6%) of total energy consumption, and typically about 10% of all industry energy requirements. The building materials industry is relatively energy-intensive, second only to iron and steel. It has been estimated that the energy used in the processing and manufacture of building materials accounts for about 70% of all the energy requirements for the construction of a building. Of the remaining 30%, about half is energy used on site and the other half is attributable to transportation and overheads. Research in the USA has shown that 80 separate industries contribute most of the energy requirements of construction and five key materials account for over 50% of the total embodied
energy of new buildings. This is very significant since considerable savings in the energy content of new buildings can be achieved by concentrating on reducing the energy content in a small number of key materials.

1.13 KNOWLEDGE MANAGEMENT

Knowledge management describes the process which can enable an organisation to exploit the knowledge and learning of its people. This can result in increased efficiency in project implementation and reductions in waste and their associated costs, and can foster greater innovations.

Knowledge is not simply information. Information is often passive: what is important is how that information is received and what interpretations and responses the receiver can make. Knowledge involves the ability to make judgements. Knowledge is typically accumulated through experience or education, but there is also a range of management techniques that can be applied to make this more effective, especially in its recall at the appropriate moment.

Knowledge management is concerned with much more than information and communication technology. It is also important to remember that a large amount of knowledge resides in people and is thus not easy to transfer to information systems. To use this tacit knowledge requires people-orientated activities such as mentoring, knowledge-sharing meetings, technical communities and networking. This may require a culture of change within an organisation in order to encourage knowledge sharing rather than discourage it.

When the Building Cost Information Service (BCIS) was first established in the 1960s there was some resistance then to the sharing of information that would assist competing firms with their businesses. During its early years, access to that service was restricted to chartered quantity surveyors. It was eventually opened up to any organisation on a subscription basis with the avowed intent of sharing information on a reciprocal basis. In this way all of the firms involved were able to benefit and to improve their professional services to clients.

Another aspect of knowledge management is its close relationship with innovation. Knowledge creation, which is a vogue word for innovation, is important in the current era with all of its uncertainties and rapid changes in ideas and practices. Innovation includes the introduction of new services and products to clients and improvements in business processes.

Knowledge management in project-based firms, which are typical in industries like the construction industry, is a particular challenge. Difficulties can arise in project-to-project knowledge transfer as well as project-to-business transfer. These difficulties are exacerbated by the discontinuities between projects and the teams that work on them. On the completion of projects teams will always, to some extent, disperse. Companies do not routinely and formally reflect on the successes and failures of a project in order to improve performance next time.
SELF ASSESSMENT QUESTIONS

1. What is the purpose of cost control and why is this of major importance to clients in the construction industry?

2. Why is an understanding of building design method relevant to the cost study and control of building projects?

3. Suggest how the quantity and quality of advice on the costs of construction are likely to evolve in the coming decade.

BIBLIOGRAPHY