1 The Construction Industry and the Quantity Surveyor

1.1 The construction industry

The construction industry is a generic term for a service industry that forms part of the nation's economy, carrying out the planning, design, construction, alteration, refurbishment, maintainance, repair and demolition of structures. The industry produces a variety of structures to create the built environment and below is a range of building types together with some relevant examples in brackets:

- Commercial (hotels, retail stores, banks)
- Offices (private and government use)
- Agricultural (farmhouses, mills, barns)
- Education and research (schools, colleges, research facilities)
- Health facilities (hospitals, surgeries)
- Aged care (homes, care centres)
- Government (embassies, prisons, police stations)
- Tenancy and fit-out (stores, offices)
- Defence (military bases, training, storage)
- Vehicle parking (private and public, single and multi-storey)
- Industrial (factories, warehouses, power plants)
- Entertainment and recreation (theatres, halls, stadiums, zoos, sports centres)
- Landscaping and precincts (soft and hard areas)
- Residential dwellings (public and private development)
- Public and civil buildings (town halls, museums, transit stations, including airports, etc)
- Infrastructure (utility services, railways, roads, bridges, tunnels)
- Religious (places and monuments of worship).

According to the Office for National Statistics, the average value of construction output by contractors for the decade 2000–2009 in Great Britain was circa £100 billion per annum at 2005 prices. Of this amount, 62% was for new work

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and 38% for repairs and maintenance. This impressive value represents an increase of 17% over the previous decade, with the percentage split between new and repair/maintenance works remaining constant. Industrial reports indicate that the decade 2010–2019 will see growth, albeit to a lesser extent than witnessed between 2000 and 2009.

The industry has over 300,000 firms employing in excess of 2 million people in a multitude of roles, including suppliers, designers, contractors, manufacturers and those suppliers of goods and services that rely on the industry. The industry is buoyant in terms of economic stability, and offers employment that expands and contracts with the amount of spending by the private and public sectors. In terms of Gross Value Added (GVA), which is the economic measure of the total value of goods and services produced in the national accounts, the industry contributes 7–9% annually and is indeed a giant in terms of the contribution it makes to the national economy and workforce.

1.2 The client's team

A client may be an individual, partnership, group of persons, organisation or business from the public or private sectors that seeks and pays for building works. Public sector means central and local governments and private sector means an individual(s), firm(s) as partnerships and limited or unlimited companies. In general, the client's role is to decide a suitable method of procurement to obtain a building, which involves a series of appointments to create teams tasked with assisting and delivering a project. The client's team is made up of the following:

The design team This team comprises of consultants from a range of backgrounds engaged by a client to specify and design schemes suitable for the client's needs. Any member of the design team may engage second tier consultants with specialist skills to assist with their workload and commitment to the client and project.

The construction team The construction team is on the supply side of the industry, a term used to describe those parties appointed to physically construct a project in accordance with the design requirements. This includes:

- A main contractor (the builder)
- Subcontractors to carry out works for the main contractor
- Material suppliers (including manufacturers)
- Suppliers of plant equipment to assist with the construction operations.

The combination of design team members and a main contractor is often referred to as the building team. Under a traditional procurement arrangement, each building team member has an agreement with the client, with subcontractors and suppliers usually having an arranged dealing with the main contractor only.

The development team Members of a client's development team are an integral part of the client's business, and are appointed to issue advice on technical, financial, legal, research and business planning matters for projects. This team also includes a geotechnical engineer who is engaged to carry out a site investigation (SI) and report on the site conditions below the surface of the ground when a project involves new works or the extension of an existing building. This is to ascertain the type(s) of subsoil(s) and test for the presence of any contamination and, if found, to provide a remedial action plan so that eventually the land is suitable for development. Other members of this team include the client's parent company (that may express an interest for corporate reasons), building maintenance and facilities managers, politicians, heritage and conservation groups and local planning authorities.

Under a traditional procurement route, the client takes a contractual role with the various team members as the employer and Figure 1.1 demonstrates a hierarchy arrangement of appointments.

Selection of team members usually commences with the client vetting referred businesses and then inviting tenders for their services in line with its procurement strategy and project requirements. The exception is the mandatory involvement of authorities, including the local planning authority and statutory or minor groups who have an interest in the project for legal reasons and in the interest of the public.

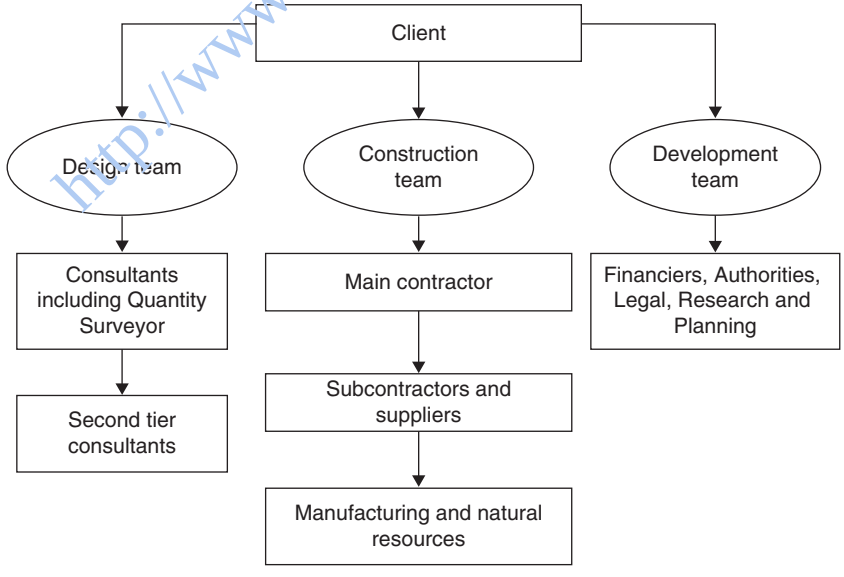

Figure 1.1

A client might be inexperienced with the design and construction process and wish to delegate some responsibility to an intermediary. This has an advantage for the client as it permits it to attend to its own business needs instead of committing resources to oversee a building project. The intermediary might be a project manager within the client's own business or an independent Project Management Company that assigns a project manager to manage the process. The project manager acts as an agent of the client and becomes the single point of contact for the building team, with all communications to the client made via the client's agent. Alternatively, the client's agent could be a member of the design team and possibly also an architect or quantity surveyor, thus serving a dual role. If an intermediary is appointed, other team members engaged are contractually bound to the client and not the intermediary with many forms of contract naming the client as the employer.

1.2.1 The professional quantity surveyor (PQS)

The professional quantity surveyor (PQS) is the client's cost consultant and cost manager for the building process. One of the services on offer to a client is *pre-contract* cost advice, which involves estimating construction costs prior to design for budgeting purposes. Thereafter, the PQS monitors the different stages of design whilst it is developed to compare with the budget, and advises the client's team of changes that impact the budget. Pre-contract services also include the preparation of trade bills of quantities for tendering purposes, vetting of main contractors' tenders, and anticipated cash flow forecasts to pay for the works whilst a project is under construction.

Once the client enters into a binding agreement with a contractor for the works, it triggers the *post-contract* period. Traditional PQS services for this period include cost management and financial certification for interim payments to the main contractor whilst work is in progress, reports on the progression of the project, valuations of changes to the works, and preparation and issue of a final account. In addition, large consultancies expand traditional quantity surveying services to provide their clients with an advisory service and project management, including:

- Recommendation of an appropriate procurement route to suit the type of project
- Risk management, including identification and analysis
- Due diligence reporting by confirming a scope of services provided in a main contractor's tender
- Selection of an appropriate form of contract
- Life-cycle costing options for various types of construction to demonstrate benefits whilst a building is occupied
- Advice on dispute resolution services if there is conflict of opinion with a contractor
- Business feasibility studies to assess the viability of a scheme prior to design

- Acting as client's/employer's agent under the title of project manager
- Certification of buildings with Energy Performance Certificates (EPC)
- Construction Design and Management Regulations (CDM) coordinator with health and safety.

The PQS may be a sole practitioner, in a partnership or operate as part of a large consultancy. To qualify, a professional needs to hold an academic degree and/or is a member of the Royal Institution of Chartered Surveyors (RICS). The RICS is the leading international body that regulates members and firms to ensure that ethics and professional conduct are maintained. Professional members are termed 'Chartered Quantity Surveyors' with the institution having the largest network of quantity surveyors worldwide. The PQS is a design team member and consultant, not to be confused with the quantity surveyor employed by a main contractor who is a commercial member for the supply side of the industry.

1.2.2 Architect

Architects usually operate from a professional practice. They are responsible for developing and coordinating a building design to ensure it is compatible with other consultants' designs, and report to a client or client's agent on the progress. An architectural practice comprises design members who create site and block plans and drawings showing elevations, plans and cross-sections of buildings. In general, a design commences from a client's brief which outlines the requirements of a project in the early stages and is conventionally produced with ink on paper or other material in schematic and sketch form. Thereafter, the design is developed using computer-aided design (CAD) software to produce details for building components that are provided on smaller-scale drawings read in conjunction with trade and product specifications drafted by the architect. Detailed drawings include cross-sections of walls, frames, roofs, etc, that show a vertical plane through the construction detail giving critical dimensions. Drawings may also demonstrate how information shown on large-scale drawings fits together as components in the final product, e.g. joinery products, junctions with ceilings and walls, etc. An architect will have an advanced building design appraised to ensure it complies with the Building Regulations and may appoint a specialist to provide certification. In addition, a building surveyor, who is preferably a member of the RICS Building and Surveying Professional Group, might be engaged if work involves the management of real estate assets such as heritage works. This is to assist the architect with the progression of the design or, alternatively, a client may decide to appoint the surveyor separately who will liaise with the architect.

Separate to building designs, an architect might design external works for a building and issue drawings and specifications that show:

- Ornamental screen walling
- fencing

- Paths, paved areas and car parking
- Hard landscaping schemes including public footways and cycle paths
- Soft landscaping schemes that encompass turf, grass, shrub and tree planting.

Some aspects of hard and soft landscaping schemes, however, may be designed by a landscape architect appointed separately by the client.

Independent and commercial architectural practices are usually members of the Royal Institute of British Architects (RIBA), which is a professional body representing architectural designers of the built environment. The accreditation is also available to individuals who must complete a recognised qualification with a minimum of five years' academic study. In Scotland, the Royal Incorporation of Architects in Scotland (RIAS) is the professional body for architecture and works closely with the RIBA to promote membership.

1.2.3 Structural engineer

When a new building is designed by an architect, the design is issued to a structural engineer for a structural appraisal. When appraising the plans, the engineer creates a structural design as a replica of the architectural proposals to provide hidden strength to a building through the foundations, walls, floor and roof, as well as product specifications to ensure a building is suitable for the intended use. When considering a type of foundation and substructure design, the engineer refers to the ground conditions obtained in the report from a geotechnical engineer. Above ground, architecturally-designed elements are analysed to confirm the suitability for the building. This involves reviewing architectural information using skill and judgement to enable the creation of suitable structural criteria. The review process considers the size, shape and functional use of a building, together with health and safety practices for construction purposes and compliance with the Building Regulations. In general, after a structural design is complete, the engineer issues the information to the architect, which may include recommendations for architectural modifications to suit the proposal. For example, walls or floors might need to be thicker than the architect's proposals in order to withstand structural stresses. In addition, the engineer may design temporary support structures, such as shoring, which is a system of bracing to stabilise existing buildings and surrounding structures so they do not collapse whilst new works are in progress. If a building is to be refurbished with the works affecting structural integrity, the structural engineer will assess the stresses imposed on existing building elements and design permanent or temporary works to suit.

During the construction phase of a project, a structural engineer reviews shop drawings provided by fabricators and checks the details for precision, accuracy and quality to permit the assembly or installation of the product into the works on site. Furthermore, the engineer carries out independent tests and reviews test results submitted by installers of installed works and has the authority to enforce the design and specification and instruct the removal and making good of any unacceptable works.

To qualify as a Chartered Structural Engineer, the Institution of Structural Engineers requires its members to undergo key stages of education and training. This involves obtaining an accredited degree and following a training programme to bridge any gap between the qualification and experience, known as the period of Initial Professional Development (IPD). At the end of this period, the graduate attends a Professional Review Interview (PRI), which must be passed together with an entry examination in order to obtain chartered status. Alternative routes apply for those who possess appropriate qualifications and have suitable experience.

1.2.4 Civil engineer

Civil engineering embraces new structures and the maintenance of existing ones in the built environment. The work also covers non-structural work, including bulk earthworks and remediation of contaminated land so that it is suitable for development.

When a new structure of a civil engineering nature is required, the civil engineer is engaged to design a scheme and write a specification for a scope of works with due concern for public protection and the environment. In addition, the service generally involves:

- Providing finished levels in relation to ground and construction items
- Issuing set-out information for the works
- Assessing tenders from contractors
- Obtaining permits
- Attending public meetings
- Supervising work in progress.

During the construction phase, the civil engineer enforces design and specification criteria and can instruct the removal of defective work for replacement in accordance with the requirements. Once a project involving a new structure is complete, it triggers a maintenance period which a contractor must oversee until the structure is transferred to an adopting authority such as local authority or other owner. For this reason, the civil engineer will work closely with the contractor and adopting authority to ensure the design and constructed works comply with the requirements to aid a smooth transfer upon the expiry of the maintenance period.

Where a project is solely engineered without requirements for a building, such as bridge structure or land remediation, the engineer takes the role of employer's agent under the title engineer or to that stated in the contract. In essence, what a project manager is to a client in a building contract as a client's agent, the engineer is the equivalent in an engineering contract.

A qualified civil engineer may be chartered and a Member of the Institution of Civil Engineers (MICE), holding a degree in civil engineering which provides a stepping-stone to other aspects of engineering.

1.2.5 Service engineers

Service engineering includes methods of supplying, installing and commissioning a system to permit utility service providers to distribute power, water and gas in a building. The term also embraces drainage, fire protection, mechanical air systems, transportation, machinery and a range of specialist services used for fitting out a building. In general, building services can account for about 30% of the cost of a project, and as the quantity surveyor is involved with cost, there is a need that he/she understands the scope that contributes to this proportion.

Electrical engineers These engineers specify and design schemes to distribute electricity for power, lighting, security, heating, information technology and communication systems in buildings. Furthermore, the discipline includes lighting for external works and methods of obtaining power supply to a building from the mains supply.

Plumbing or hydraulic engineers This engineering discipline involves the design and specification of water and gas supplies, heating and building drainage systems within buildings, as well as solar-controlled plant machinery for producing hot water supplies.

Fire protection services engineers These engineers author a fire-engineering report to identify potential fire, smoke and heat hazards and/or design, and write specifications for a building design so that it complies with a fire-engineering report. Designed schemes include active and passive measures incorporated into a building design to protect the structure, contents and occupants from the effects of fire, smoke and heat. Active measures include sprinklers, fire blankets, hydrants and hand portable extinguishers, and passive measures are architecturally-based, including doors, partitions and escape routes. Hydrants for use by the fire brigade may fall under the category of water services and possibly are included in the water supply design provided by the hydraulics engineer.

Mechanical and air conditioning engineers These engineers provide a design and specification for naturally-flowing and fan air-assisted systems to provide a building with a suitable atmospheric pressure as well as adequate heating, ventilation and air conditioning (HVAC). HVAC refers to technology that provides suitable air changes and thermal comfort to a building's internal environment.

Transportation systems engineers Engineers under this category create designs and specifications for lifts and escalators for vertical, horizontal and inclined movement in buildings to deal with a stream of people or products transported by the building's occupants.

Other engineers There is a range of other engineers who provide designs and specifications for works of a specific nature that are often project specific. These include:

- Waste-disposal systems
- Solar heating

- Oil-fired heating systems
- District heating for distributing mass generated heat (gas, cogeneration or solar) from a source to a number of buildings simultaneously
- Types of mechanical plant for specific use, e.g. cleaning swimming pools.

As with other engineering disciplines, chartered status affirms credibility and is gained by the successful completion of recognised courses that measure knowledge, competence and practical training. Large service engineering companies may employ their own quantity surveyors who are usually engineers trained within the appropriate field of engineering and acquire the position after completing a course of training in commercial management.

1.2.6 Main contractor

In general, a main contractor constructs a project in accordance with a binding agreement it has with a client. The main contractor does not normally carry out all of the works itself and will subcontract most trade works often without client involvement, thus giving the contractor the main role in procuring, constructing and delivering a scheme. Standard forms of contract generally omit the title 'Main' and recognise the capacity as 'Contractor'. The main contractor's role involves:

- Site-management duties and providing site accommodation comprising offices and amenities for personnel and operatives engaged on the site
- Managing health and safety procedures
- Coordinating, planning and supervising construction works
- Reporting periodically to the client and coordinating with the client's team where necessary
- Ensuring budgets are maintained
- Implementing a method of quality control to ensure works are achieved in accordance with the drawings, specification and conditions of contract.

Contracting companies vary in size, and range from small businesses employing a minimum number of people to suit the needs of the business to larger local, national, and international companies delivering a range of project types. In order to deliver a project, a contractor will need to assign a team. A team representing a main contractor on a large project valued at, say, £5 million is known as the site management or project team and is made up of the following members:

- Project manager in charge
- Site manager
- Structural and finishing trade supervisors
- Health and safety officer
- Quantity surveyor
- General site operatives
- Administration support staff and trainees.

A project of less value might have reduced site management by possibly omitting finishing trade supervisors, leaving supervision to the site and project managers.

The role of the quantity surveyor on a project under construction involves dealing with post-contract activities that differ from the PQS's, who of course is appointed by the client as a consultant and will have dealings with the main contractor's quantity surveyor. Normally, the quantity surveyor is answerable to a commercial and/or project manager, and the role addresses commercial, administrative and contractual responsibilities that include:

- Cost reporting
- Awarding orders to material suppliers and subcontractors
- Ensuring project insurances are current
- Vetting health, safety and environmental submissions from subcontractors for compliance with the contractor's project health and safety plan
- Providing a flow of information to a contractor's supply chain, i.e. material suppliers and subcontractors
- Assessing the price of variations
- Making applications for payment from the client
- Processing payments down the supply chain.

Team members may be qualified chartered building professionals and Members of the Chartered Institute of Building (MCIOB). The CIOB is the leading construction management voice in the construction industry and its members represent a body that has knowledge about the management of the building process.

1.3 Legislation and control of the building process

Whatever the type of building project, design and construction operations must comply with built environment legislation, which is enforced by planning control and appropriate regulatory systems. Generally, if anyone wishes to build, it is necessary to obtain permission from the local authority before commencing works in order to confirm the design and works comply with the law. With small projects, the approval procedure may be straightforward and building owners can seek permission themselves. However, with large projects, the process can be time-consuming and complex, and whoever is seeking a building might appoint a project manager or other professional to manage the procedures. Culturally, it is prudent for the industrial professional involved with planning to be aware of practices, customs and local laws or byelaws relevant to the community where the building is to be constructed. Byelaws are parochial powers granted from central government by an Act of Parliament to local authorities, enabling them to make decisions relevant to the community. Failure to observe byelaws and starting construction works without approval may result in the local authority instructing that the works be demolished.

Minor changes to buildings (usually for residential purposes) are termed Permitted Development and are usually exempt from formal approval. However, it is wise to check with the appropriate local authority about what they consider permissible prior to commencing any works. If approval is required, the process involves seeking clarification of the planning requirements and confirmation that the design complies with the Building Regulations. In addition, whoever carries out the design and building process must affirm a commitment to safe working practices as required by health and safety laws.

1.3.1 Planning approval

When a building undergoes a material change of use from one classification to another, e.g. changing a residential property into commercial premises, appropriate approval is required which is legislated by the Town and Country Planning Act 1990. The approval process commences with an applicant lodging a formal proposal, usually including a set of building plans and elevations, which activates an assessment procedure by the local authority to enable it to arrive at a decision. Part of the process involves assessing the submitted details to ensure the completed building will comply with the Building Regulations and meets legal standards to protect the health and safety of the end user and the public. Certain buildings are exempt from this part of the process, including some temporary buildings and buildings where the public rarely goes. However, it is wise to check the status before carrying out any works, as proof of exemption from the Building Regulations may be required as part of the approval process.

To arrive at a decision, the local authority's assessment takes into account the building process and impact the completed project will have on the built environment. This includes assessing the status of existing public and private buildings, amenities, infrastructure and influence on the Local and Development Framework Plans. These Framework Plans outline a local authority's future long-term controlled changes to an area that are in place when an application is received and which can cover ten years or more. The length of time it takes to issue a response varies with the type of application as well as the local authority's policy and the complexity of the scheme. If the scheme is approved, information is issued to the applicant granting outline planning permission where intent to develop is accepted in principle and subject to further review. This will be received with a sigh of relief to the applicant as it means the scheme is generally accepted and the process of preparing design information can progress beyond that submitted with the application. This stage of the approval process will aid a landowner who wishes to sell a parcel of land for development. This is because outline planning permission is required prior to the sale of land as, without the permission, the land may be worthless.

The second stage of approval is acceptance with reserved matters. This means a scheme can proceed and is subject to a set of terms and conditions that is discharged over time, usually by the end of the construction phase. An example

of this stage of approval would be if an application is lodged seeking permission to construct a building where building plans are submitted without details of an adjacent landscaped area. The local authority's response may be to grant permission to build, with a reserved matter stating the final works must be completed in accordance with the landscape scheme which is yet to be lodged and approved.

The third stage is for full planning or detailed planning permission, which is approval to develop without conditions and, understandably, the favoured outcome. If an application is refused, the applicant may lodge an appeal but this can only be lodged if it relates to specific matters permitted by legislation. These matters include:

- Legalities involving covenants, i.e. the existing ownership of land, buildings or parts thereof not owned by the applicant
- A request to review existing outline planning permission not recognised by the local authority
- Resolution of conflict between outline planning permission and any existing Local and Development Framework Plans.

Until resolution of an appeal, the applicant would be unwise to commence building works as the local authority would probably instruct the removal of anything built and impose fines.

1.3.2 Building Regulations and control

Building Regulations are statutory requirements that seek to provide guidance and define standards for the purpose of designing and constructing buildings. They are contrived with skill to ensure a completed building is constructed with due consideration to the environment and the health and safety of the occupier and public. The current regulations comprise of 14 parts and include items such as structure, ventilation and hygiene. Each part explains standards and requirements for compliance illustrated by explanatory text and diagrams. The Regulations are modified from time to time to reflect changes in legislation, which may apply to any part at any time. The enabling act empowering the Regulations is The Building Act 1984 (England and Wales) that underwent change to become the Building Regulations 2000 (England and Wales). In Scotland, the driving legislation is the Building (Scotland) Act 2003 that steers the Building (Scotland) Regulations 2004.

A contractor constructing a building must ensure works comply with the approved design and implement a method of controlling operations during the construction phase. A diligent and experienced site manager will ensure works in progress are carried out in accordance with an approved design by making regular checks. However, and to ensure compliance with the Regulations, it is necessary for the client or contractor to adopt a level of

control with independent inspections. This is carried out by representatives of the local authority or independent building inspectors in consultation with the contractor's site manager. The representatives of the local authority and inspectors have delegated authority to authorise the destruction and rebuilding of any works that do not comply with the Building Regulations. Under a separate arrangement (usually upon the advice of the client's agent), a client may appoint a clerk of works, who is a skilled tradesman engaged to inspect works in progress. The role is one of inspector only and the clerk cannot issue instructions to the contractor to alter works and can only enforce the contractor's agreement with the client. The clerk can enforce compliance with the Building Regulations if a contractor fails in its duties to construct works that do not comply that may go unnoticed by a building inspector. Usually, it is only the client's agent who can issue an instruction resulting in a variation of the works and who may do so based upon reports from the clerk's inspections. For example, the client's agent might request the opening up of covered works such as a backfilled drainage trench to see if the pipes are encased in concrete as specified and direct the clerk to inspect. Any subsequent instruction by the client's agent based upon the clerk's findings is enforced by the contract because, as a matter of procedure, the parties acknowledge their legal obligation to comply with the Building Regulations. In essence, the clerk of works inspects the works to ensure they comply with the contractual agreement and a building inspector enforces statutory requirements for the Building Regulations. The contractor must face these levels of building control and has a legal obligation to comply with both.

1.3.3 Health and safety

The adoption of a suitable and proactive health and safety system is an important factor for the successful delivery of a project. The positive culture it creates has advantages to a contractor that includes:

- Improved productivity and quality of work
- Lower staff absence and staff turnover
- Reduced insurance premiums
- Promoting good corporate image.

Significant legislation for the United Kingdom construction industry occurred with the introduction of the Health and Safety at Work (etc) Act 1974. Broadly, this Act is a fundamental structure for the encouragement and regulation of general duties and responsibilities of health, safety and welfare applicable to employer, employee, contractor and any persons involved with the workplace. The Act also sets the basis for the establishment of the Health and Safety Executive (HSE) as enforcer of the Act and which is empowered to delegate authority to health and safety inspectors.

The status of health and safety in the industry received a legislative boost in the 1990s with the introduction of the Construction Design and Management Regulations 1994 (CDM 1994) that had the aims of improving safety through the design, construction and occupational phases of a building project. Following the enforcement of CDM 1994, HSE statistics declared a fall in the number of fatalities, major injuries, and injuries that resulted in over three days absenteeism from work, a result arguably arising from the legislation. However, CDM 1994 became the subject of scrutiny by contractors and industrial leaders, including the HSE, because of its bureaucratic approach that appeared to create apathy. The compounding effects of the scrutiny over the years led to its cessation and it was eventually replaced with CDM 2007. This current five-part legislation reduces the complexity of its predecessor, using simplified language for regulations that benchmark rules for working activities lasting longer than 30 days or involving 500 or more person-days.

Under CDM 2007, a CDM coordinator (instead of a planning supervisor as required by CDM 1994) is appointed to oversee safety design management. This new role extends the original duties and includes an expressed obligation for a coordinator to prepare and/or update health and safety files. The coordinator is engaged in the early stages to issue advice to the design team on safety policies as well as information for planning the stages of work. When a project is subject to the rules of CDM, a principal contractor is appointed; this may be the main contractor responsible for delivering the project, or a management contractor in a supervisory capacity that has a responsibility to implement a construction phase health and safety plan. The plan is implemented through written risk assessments and method statements of working operations. Furthermore, the regulations call for good practice, which is achieved by adopting a register of site safety checks as well as the collection of material safety data sheets and the recognition of a hierarchic management structure within a construction company. The role places the onus on the contractor and subcontractors to embrace the use of systems, including the collection of data and reporting procedures, whilst works are in progress.

CDM coordinators are not empowered to approve or check designs, or approve and supervise the principal contractor's construction phase health and safety plan. Neither are they empowered to monitor the works on site as this is the principal contractor's duty. During the construction phase, the principal contractor will liaise with the CDM coordinator regarding ongoing design activity. This is updated by the CDM coordinator whilst the principal contractor supervises the scheme in accordance with the approved plan.

1.4 Industry networking

Networking is an expression of interest in a subject using resources, contacts and advice for growth and development. The use of networking may be for personal gain or benefit to the industry, employer or professional community.

Two significant professional bodies involved in networking in the construction industry are the Royal Institution of Chartered Surveyors (RICS) and the Chartered Institute of Building (CIOB). The RICS and CIOB have their head offices in the United Kingdom with additional offices worldwide. Professional members of both institutions enjoy the benefits of networking the industry at national and international levels and must comply with the rules of membership.

1.4.1 RICS

The RICS was founded in 1868 and is a regulating body that recognises qualifications in land, property and construction. It has approximately 100,000 professional members worldwide (as at 2011), of which 40% are quantity surveyors. The institution has a number of professional faculties, including Quantity surveying and construction and Project management, which are part of the Built Environment Professional Groups. Other faculties that form part of this group are Building control, Building surveying, and the Dilapidations and Insurance forums. The Institution has aims that:

- Promote research for development
- Regulate and maintain membership ethics and standards
- Carry out market surveys with comments and forecasts for business and governments
- Improve and promote the various professions through educational links
- Publish books appropriate to the business of the RICS.

Approximately one third of members is in the student class. This class offers students career advice, help with studies and networking through RICS matrices to provide an active programme of social and charity events and to build a network of contacts in the industry. Students must have commenced one of the accredited (cognate) courses, which include Higher National Certificates and Diplomas (HNC/HND) or degree courses relevant to the profession which can act as stepping-stones towards chartered status.

The traditional method for obtaining chartered status is along the graduate route and requires candidates to graduate with a cognate degree and complete a structured training programme combined with work experience. Traditionally, a postgraduate commences structured training and experience in order to obtain APC (Assessment of Professional Competence), which is the measure of an acquired qualification linked with practical training and experience in a related field of work, e.g. quantity surveying. Students enrolled on cognate courses can commence the APC pathway whilst studying or in employment, which involves regular meetings with a counsellor who is a member of the RICS. The structured training and work experience minimum timeframe for training is two years. During this time, the student records their training and experience in a logbook and produces a mandatory record

that includes details of professional development. This information is collated and issued as part of a Critical Analysis Report which is issued as a final submission. Subject to the submission being acceptable, the candidate attends a professional interview as a final assessment with an RICS panel to discuss the Report and to test the candidate's understanding of professional practice and ethics. The panel later completes its assessment with either a recommendation for membership or a deferral. If successful, the student is invited to enrol as a Professional Member and, if accepted, receives chartered status and is permitted to use the initials MRICS. Alternative routes to the graduate pathway are Associate, Senior Professional, Adaptation and Academic. The entry requirements for these routes vary and are suitable for persons with various levels of experience and qualifications, or are members of affiliated organisations.

Individuals and companies may apply for chartered status and, once accepted, are bound by the Rules of Conduct for maintaining ethical standards. The RICS is self-regulating and responds to the needs of the profession. Because membership routes may change, those interested in becoming members should become acquainted with current information which is found on the RICS website, www.rics.org.

1.4.2 CIOB

The CIOB has a national and international reputation for excellence in construction matters. The institute places particular emphasis on construction management and the sharing of knowledge with companies, members and clients that influences the way the industry operates. It was founded in London in 1834 as the Builder Society, was incorporated as the Institute of Builders in 1884, changed its name to the Institute of Building in 1965 and was granted Royal Charter in 1980. The total number of individual members is in excess of 47,000 (as at 2011). However, there is capacity for this to expand because of the number of registered Chartered Building Companies that employ consultants and staff who may be eligible for membership.

The traditional route to professional membership is along the graduate route where candidates follow an educational pathway that requires graduation from a cognate degree and training along a Professional Development Programme (PDP). The PDP is a measure of a candidate's educational qualifications combined with practical learning and experience to assess occupational competence. A candidate's education and occupational experience is measured within a framework of support involving a CIOB-approved assessor who reviews and endorses the candidate's assessments. Completion automatically entitles the student to attend a Professional Review where a panel assesses a candidate's industrial and management competence, together with his/her commitment to professionalism. The panel's decision is graded as a pass, conditional pass or deferral. A successful interview allows a candidate to apply for professional membership which, when

granted, permits the professional to use the credentials MCIOB. Alternatives to the graduate route are available to any persons without appropriate qualifications who are company directors, contracts managers or senior managers of appropriate companies and who agree to follow a structured training programme. Other routes are available for persons who are members of organisations affiliated with the CIOB, hold a cognate/non-cognate degree and are industrial professionals working at senior level with a minimum of 10 years' experience.

There is also a two-tier membership system available for technicians who seek admission to the Incorporated and Associate classes. Members admitted to these classes are entitled to use the initials ICIOB and ACIOB respectively. An Incorporated member must be HND- (Higher National Diploma) qualified or have received exemption from the Institute's examinations. An Associate must have acquired HNC (Higher National Certificate) status as well as completing a minimum of two years' working experience. Students may commence learning along an HND or HNC framework and may receive the Institute's grades, which act as an incentive towards attaining chartered status. Current membership criteria and the most recent information can be found on the CIOB's website, www.ciob.org.uk.

Benefits of membership Benefits of membership of the RICS and CIOB include:

- Status and respect from clients and colleagues
- Invitations to seminars to learn about current industrial and business trends
- Legal advice
- Eligibility for assistance from benevolent funds
- Career advice
- Discounts on insurances, software and financial services.

Continual Professional Development (CPD) One of the requirements for professional membership of both the RICS and CIOB is a member's commitment to updating knowledge and skills in order to remain competent using lifelong learning (LLL). Methods of carrying out CPD include attending courses and seminars through work, social activities and invitations from professional bodies and through private learning. To be effective, learning should aim to improve knowledge of subjects that a member considers are important to their employment and profession. Advantages of CPD include:

- It updates and refreshes knowledge from educational courses
- It acts as a catalyst for the learning of new subjects
- It improves competence in business which may provide enhanced employment prospects.

Variance of a work task within a normal working day is not normally part of lifelong learning. However, skills gained through study or coursework to

Table 1.1 Logging and goal setting record for Continual Professional Development

Item	Goal	Current skill level	Required skill level	Learning method	Start date	End date	Learning outcome	CPD hours
1	Maximise business development potential	2	3	7	TBA			
2	Learn principles of teamwork	2	3	6	TBA			
3	Acquire knowledge of IT and the software system to be used on new projects	1	2	4, 7	TBA			

KEY:
Skill levels
1 = Limited 2 = Aware 3 = Competent
Learning methods
1 = Day release 2 = Evening course 3 = CPD event 4 = Private study 5 = Internet
6 = Work base project 7 = Employment training 8 = Other
TBA = To be advised

increase competence could be considered sufficient, e.g. training in the use of computer software for improved business acumen. To monitor learning for use as CPD, it would be wise to plan objectives and then focus on methods of obtaining sources to achieve the objectives and logging the achievements once they are learned. To aid the process, the number of learning hours should be recorded – a usual timespan is 20 hours per year, although this is not mandatory. The record should include the title of the subject matter to be learned or updated, objectives, chosen learning method and the considered level of skill before and after the event. There are various methods of recording this information which may be on a computer spreadsheet, or in a diary or a notebook. Table 1.1 demonstrates goal setting and logging objectives for self-learning a number of different CPD events.

1.5 Funding and market drivers

The construction industry relies on funding to spend on developing construction projects and this is obtained from financial reserves derived from the public and private sectors. Public sector funding is generated from accrued local and central government reserves and is obtained by income from various taxations, rates and set-offs, whereas funds for spending by the private sector are generated from loans, reserves, investments and windfalls.

The various types of project funding and spending for each sector are:

Public

- Government-backed schemes
- Issue of grants
- Defence projects
- Government building upgrades or new works
- Overseas grants (European Union/International Monetary Fund, etc)
- Government stimulus packages.

Private

- Cash reserves and equity
- Private and corporate loans and mortgages
- Company profit and investments
- Insurance works
- Profit withdrawal from the sale of stocks and shares
- Charities
- Religious organisations
- Investment strategies from businesses and individuals
- Land banks, i.e. reserved funds to acquire land to develop property
- Government incentives.

Funding of construction projects in either sector is subject to change, which may be the result of an economic cycle or due to a specific event impacting the national economy. When the economy expands, the construction industry is usually the first to witness expansion as the demand for buildings increases. Conversely, it may be the first to witness decline. When local authorities and central government play positive roles in the stimulus of an economy, they influence industrial output and create interest from other sectors, which increases socio-economic development. An increase in socio-economic development creates an abundance of funds which in turn increases spending that leads to expansion of the construction industry. Neglect or decline, of course, have the reverse effect. In order for central government to monitor growth or decline, it relies on data provided by advisory bodies such as the Office of National Statistics. This data provide a snapshot of the industry at any time with the status generally regarded as a reputable indicator to the strength of the national economy as a whole. This information is often relayed in Treasury reports that could act as catalysts for the funding of public works which act as market drivers.

Market drivers are processes at local and national levels that drive the supply and demand of services for the construction industry and which fluctuate over time. When there is an abundance of contractors, trades and professionals without consumer demand, it leads to lower prices and a surplus to employment requirements with a negative impact on the workforce. By contrast, when consumer demand is high and the supply remains unaltered, prices are driven up and there is a need for additional resources, i.e. more employment. If the supply is increased to meet the demand, it creates equilibrium and the control of prices.

Markets are driven by events and circumstances that influence the level of supply and demand which is linked to spending from the public and private sectors. One such event is an economic recession that triggers a reduction in spending and starves the industry of projects. By comparison, an increase in demand creates a surge of supply, albeit for circumstantial reasons, which is usually for the short term and which may be perceived as a temporary fix to a prolonged problem, such as a lack of overall demand. This can be modified by a correction in the amount of long-term public spending under the control of local and central governments, which contributes to more than half the number of projects undertaken by contractors.

Other market drivers include trading partners in allied industries because the status of one partner can influence another, as found with exports and imports. A positive example of a market driver is the success of the mining sector in the Australian economy, which has enjoyed a resources boom since 2005 due to the remarkable growth of the Chinese economy. China has a high demand for the supply of ore used in the manufacture of iron for conversion into steel to satisfy the needs of her construction industry. The ore is abundant in Australia, leading the way for the material to be mined for export to China. This market driver has boosted the Australian economy and benefited mining

and construction industries as consumer demand for commodities such as housing stock has increased. By default, it also benefits the Chinese steel and construction industries. The luxuries of positive market drivers found in this example include economic security and resilience to recession that lead to employment stability and economic growth and are certainly the basis of a strong economy.

1.6 Economic and construction cycles

The gross output of the construction industry is measured as the sum of completed and uncompleted projects over a specified period captured from data from national statistics. When statistics show an increase in demand for projects, it encourages optimism that leads to confidence and allows businesses to plan ahead with investment strategies. In general, this optimism leads to an increase in the purchase of properties and consumer goods which increases construction output.

The output of the construction industry depends on the national economic cycle at any time and, historically, most cycles run their course over a period of seven to nine years. When growth is sustained at the top of a cycle (or boom), a slowdown eventually occurs with rising interest rates leading to diminishing share and commodity prices, tighter money and a depressed property market to the bottom of a cycle. Once at the bottom of the cycle, the economy is vulnerable and may trigger a recession (bust) when the economy deteriorates and retracts. A recession is normally short term unless special circumstances entrench the decline. No circumstance in recent times has been as severe as the Global Financial Crisis (GFC) of 2008–2010 that entrenched a recession in various parts of the world. The GFC is an isolated case that impacted on a massive scale. However, it demonstrates what can happen at the bottom of a cycle, making it hard for struggling businesses to survive. Low demand for building work during a recession may mean competition for contracts with businesses working to reduced margins or no profits at all. This exposes businesses to risk in order to obtain cash flow to remain solvent and they may need to rely on short-term borrowing in an attempt to remain in business. The aftermath of a downturn and possible climb from recession starts with a fall in interest rates and continues with rising share values, better commodity prices, easier money available and the eventual increase in property prices back to the top of the cycle. A demonstration of this cycle is shown in Figure 1.2.

Figure 1.2 shows the key characteristics of an economic cycle that are reflected in the construction industry. The pattern of these events can affect investments that drive or diminish the demand for buildings. Falling interest rates encourages more lending and activity for construction work with the opposite in force after a boom. Knowledge of these trends permits developers and design teams to be aware of the likelihood of changes in demand over both

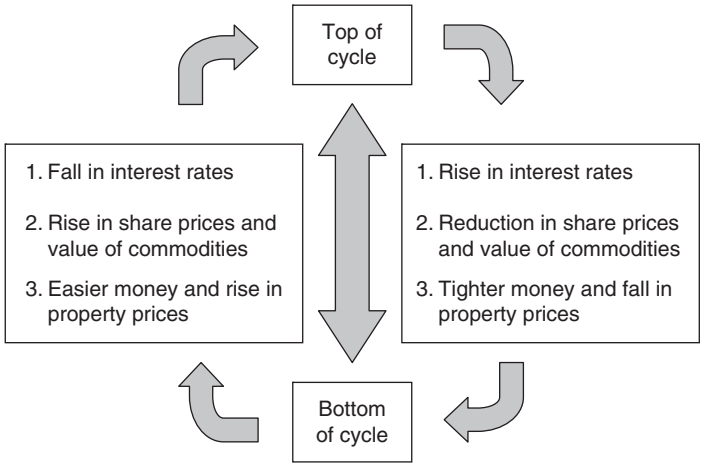

Figure 1.2

long- and short-term periods and to implement strategies for future planning. With this information, decisions can be made around the risks and opportunities available in specific markets to recognise the type of consumer demand that will be in force at given times.

1.7 Global construction

According to a report entitled *Global Construction 2020*, published by Global Perspectives Ltd based on their partnered research with Oxford Economics, the global construction market for 2009 accounted for approximately 13% of world output. This is expected to increase to approximately 15% by 2020, with China predicted to overtake the United States as the world's leading construction market by 2018. For the period 2010–2020, Western economies in general are predicted to see growth, albeit to a lesser extent than that of the previous decade, with a number of non-Western nations predicted to grow at a better rate.

Countries normally rely on their own national companies and citizens as the primary source of construction development and recruitment. However, with an international network of recruitment and professional institution reciprocal agreements in place, foreign involvement in filling skill shortages and corporate investment in projects is becoming widespread. Successful foreign involvement or investment in schemes by companies can lead to the expansion of a business and the opening of overseas branches that raises the corporate profile. Integration by a construction company with the construction industry of another country requires a commitment of time and resources and a risk management strategy is normally carried out by any

business seeking to diversify its interests. This includes an understanding of the following:

- Financial stability of the country
- Performance on completed projects
- Health, safety and environmental attitudes
- Population growth
- Availability of 'home grown' labour skills and material resources
- Political stability of the country
- Cultural working practices
- Existence of corruption
- Legislation with planning and building control
- Currency rates of exchange
- Land availability and terrain
- Sources and status of utility services
- Terrorism and militants
- Communication methods including knowledge of the language
- Climate and volatility of the scheme to natural disasters, i.e. earthquakes, hurricanes, etc
- Set up and/or relocation costs
- Business development potential
- Processing time and availability of working visas for employees who would relocate.

These items are the drivers for realisation and potential of an overseas investment that require careful consideration prior to commitment. With effective strategies and the potential analysed, involvement with overseas business investment may prove worthwhile. A fine example is the company Laing O'Rourke, created when R. O'Rourke and Son bought out John Laing Construction in 2001. Since formation, this company has grown internationally, with offices in the United Kingdom, Ireland, Germany, Canada, India, Hong Kong and Australia executing projects in building and construction as well as other sectors such as investment and development, manufacturing, infrastructure and support services.

1.8 Development of the quantity surveyor

1.8.1 Background

In 1785, Henry Cooper, the son of a Master Builder, set up Henry Cooper and Sons in Reading, England and in 1799 opened a London office that dealt with measurement and the cost aspects of building works. The mid-19th century saw the use of 'measurers' or 'master tradesmen', who were called upon to assess the amount of materials and labour required for building operations. At this

time, clients employed an architect to design a building and invited builders to submit tenders. There was only one way to assess a cost for a tender and that was to measure the works and apply a rate. The 'measurer' created schedules for competing builders, each of which would apply their own rates to the schedules to create a price. Clients, however, were inquisitive about the cost to construct pre-tender, which set the path to the birth of the independent quantity surveyor who was appointed separate to the architect. The given task for this new entity was to measure and assess the cost of works prior to tender and assess the cost of changes during the construction phase. Demand for this service in the late 19th century led to the expansion and recognition of the role as a profession which, in turn, was set up within the RICS, an institution with a majority of English-speaking members.

The migration of professionals from England has seen the transfer of knowledge and the teaching of techniques on an international scale with global expansion of the profession. This expansion has created quantity surveying institutions in a number of countries with reciprocal agreements in place where each recognises the other's qualification.

The solid foundation of the quantity surveyor's role is based upon a thorough knowledge of construction techniques and competencies to measure works and assess rates that determine a cost. This is linked to the capability of administering contractual and commercial aspects of projects. It would be incorrect to perceive the role of the modern quantity surveyor as one of a mere measurer of materials and trade works, as quantity surveying has expanded to create different job titles that attract additional responsibilities in the process. Responsibilities include the management of financial, contractual and commercial matters that apply both before works commence and during the construction phase, which carries a degree of decision-making obtained from a diverse set of skills. Prior to the role's expansion, there had been a general lack of understanding from other industrial professionals about advice issued by quantity surveyors for cost aspects of a project, as it appeared inconceivable that anyone could provide cost advice without a design. The background for issuing this advice is with the systematic recording of past projects in a database collected by both the PQS and contractors. For the PQS, the role has been perceived by some as one of cost advice only without management of the advice; this created a vacuum resulting in cost overruns, much to the dissatisfaction of clients. It is possible to fill this vacuum with the use of cost planning where the PQS monitors designs prepared by consultants engaged by a client through the various stages of design development to ensure predetermined budgets are maintained. With alternative procurement routes available, clients may bypass this approach by ensuring contractors take responsibility for design and construction costs, thus providing financial certainty to cost advice. Here, the contractor's professional staff acquires knowledge and confidence to provide a package service and can design and build a project to a sensible, predetermined budget that satisfies the client if they do not wish to engage consultants direct.

1.8.2 Personal traits and skills

For those with knowledge of the industry, the role of the quantity surveyor is both recognised and established, yet outside the industry it is not so familiar. So what influences someone to become a quantity surveyor, a title somewhat unfamiliar to the public? The answer could be family influence via a parent or caregiver who is a quantity surveyor or possibly an industrial professional or tradesman who has an entrusted role to provide career advice. Or it might be the result of a review of career study options in school or college or via a friend or network of friends employed in the industry who consider it a suitable role for a certain individual. Traits within a personality may assist with the progression of skills and the details are shown in Figure 1.3.

Traits may be natural and, when assisted by education and experience, can develop as skills. In summary:

- Skills
  (a) A flair for mathematics, figures and geometry is of value because this skill set provides an understanding of measurement and the use of financial calculations. In addition, problem solving and logical reasoning will be of benefit.
  (b) An ability to concentrate for long periods and accepting the office as part of the working environment, which applies on or off a building site.
  (c) Quantity surveyors require good literacy and concise communication skills, including a good command of oral and written techniques and the ability to use information technology systems. Language for

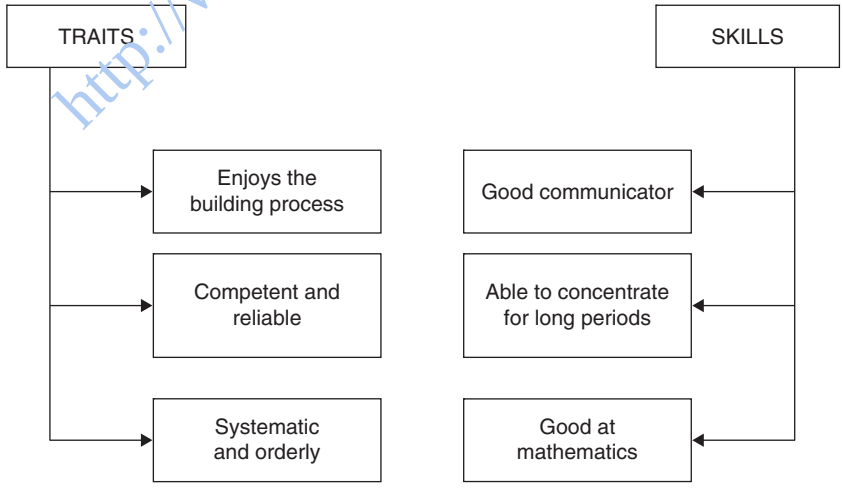

Figure 1.3

reporting on project activities needs to be precise, with an understanding of when and where to use jargon as not all readers may understand every aspect of the professional language used. Where possible the use of diagrams to illustrate points will make better communication than describing something with a thousand words.

- Traits
  (a) Traits also stem from a person who is systematic, orderly and a reliable team member. For example, a quantity surveyor may prepare a bill of quantities that describes trade works for an estimator who relies on the bill to include descriptions and measures that are clearly understood in order to produce an estimate of cost to construct a project.
  (b) Competency stems from a sound knowledge of the building process that embraces materials, customs, construction technology and economic factors. In addition, suitable skills are required to understand the role of industrial relations and the range of disciplines involved for a project. The quantity surveyor requires an understanding of project management and knowledge of contract law including the reasons for a contract to exist which is valuable for the administration of a project.
  (c) Natural prerequisites would be to enjoy the building process, as well as having a thirst for knowledge of building techniques and customs and the ability to thrive being a team member with an attitude of wanting to learn.

1.8.3 Time and self-management

Construction projects often develop at a fast pace and often there is need for anyone involved with managing a scheme to time manage effectively in order to achieve desired objectives. Effective time- and self-management creates good working habits and helps to develop a mindset for overcoming obstacles which is important if deadlines are to be met. The following tips are aimed for individual use to assist in achieving a desirable outcome on any active working schedule.

- Clear the working desk of clutter and organise the workspace with documents in order of priority. This also applies to electronic filing and storage.
- Avoid keeping documents as attachments in emails by storing them in a project file on a computer as quickly as possible after receipt. This reduces the chance of losing any documents when deleting emails. It also eases the burden of responsibility of being the only recipient of information.
- Make use of management tools by creating 'to-do' and priority lists and using a calendar for logging events in advance. With a calendar, a maximum of two weeks in advance would be sufficient because anything longer requires flexibility.

- Give yourself small self rewards after completing any of the management tool items.
- Plan and set realistic goals by starting with the small items and breaking each into smaller steps that progressively lead to the desired goal.
- Be efficient and plan each day by filling gaps of time with small items of work that can be completed easily.
- Go with your internal clock and, if a morning person, get in early and finish on time.
- If in full swing on a task, go with it, see it through and capitalise on the motivation.
- Work on a day-to-day basis and deal with matters that need completing within the day. Where this is not possible, either draw a line in the sand or phase the work and completely finish one section before commencing the next.
- Remove distractions and stay focused on the subject. Jumping from one task to another is not advantageous.
- Learn to be concise and create the self-confidence to be able to make quick decisions.
- Do not over-commit or be afraid to say no.
- Overcome procrastination by doing the hardest things first. They will have to be faced at some time and, once they are out of the way, the easier things will usually become easier.
- Recognise and change any negative thoughts about a task by anticipating the enjoyment and relief in getting the job done.
- Use effective delegation when possible. Ensure you communicate intent with the person or persons you wish to delegate to instead of dumping any workload on them without prior notice.

Applying some or all of these tips will create effective time management as it is certainly better to work smart and produce more than to work hard and provide less.

1.8.4 Education and training

Generally, students commence a course of studies lasting for a period of four years, following a set curriculum to achieve a university degree. Early semesters revolve around core subjects of construction technology, industrial relations, management, building materials, contract law, quantity surveying and building services to provide the student with an understanding of construction at a technical level. Thereafter, training becomes more in depth and to an advanced level, dealing with the specifics of the core subjects in further detail and involving sub-topics that lead to examinations. Students may be content with only passing a degree or may seek chartered status in addition to a qualification. There is an abundance of degree courses available in the United Kingdom recognised by the RICS and CIOB as a pathway for achieving

chartered status. If the aim is for chartered status with the RICS or CIOB, students need to be aware of the appropriate degrees because the decision to transfer or leave partway through a course could be costly in terms of both time and money. If seeking chartered status, students may elect to begin a probation period set by the appropriate professional bodies whilst on a degree course. The subject of achieving chartered status with the RICS or CIOB is discussed in Section 1.4 above.

1.9 Construction innovation and the quantity surveyor

Since the 1990s, probably the most salient features of innovation influencing the construction industry have been the growth of information technology and changes in environmental attitudes. As these subjects change regularly, it is in the interest of the quantity surveyor and others engaged in the industry to remain innovative by exploiting CPD to its full potential. This is required in order to keep abreast of continuous growth in these subjects as they influence the way we work and the buildings that are produced.

1.9.1 Information technology (IT)

Traditional communication methods for relaying information such as post, fax, meetings, courier, and telephone are still in use and no doubt will remain so. With the growth of IT, modes of communication have expanded from relying on traditional methods and modified the way we work. With the introduction of electronic systems, data is relayed faster which aids the design and construction process, thus saving on the duration of construction projects.

Emails

The simple use of text emails is a part of everyday life for a business and is a suitable method of communication. However, time spent on a computer can take up a lot of time, which can be managed with netiquette. 'Netiquette' is a phrase introduced since the start of the World Wide Web and concerns the social conventions of email dialogue by keeping text concise and clear in order to reduce the time spent on computers. In addition to text, emails are also suitable for issuing files to one or more recipients at the same time. These includes spreadsheets, letters as word documents, presentations, drawings and scanned portable document format (.pdf) files created by Adobe Systems that are included as attachments and opened by anyone with the appropriate software. Emails are also a suitable method for the exchange of drawing information other than scanning. This is possible by using files such as .DWG, .DXF or similar carried out by an interchange within AutoCAD (Computer Aided Design) software systems to transfer graphic programmes, usually with copyright protection. As this has grown in popularity with construction projects,

forms of contract may include conditional clauses on the method of exchanging electronic information to ensure parties act efficiently and responsibly. An obvious advantage of emails is the rapid transfer of information. However, a downside is the size of files sent as attachments because the recipient's capacity must be capable of receiving the sender's information.

Document communication systems

Collaborative document transmission is the distribution of project management information such as drawings, meeting notes and general correspondence through a host network. Once information is uploaded to a selected network, authorised recipients receive an email informing them that the details are available for retrieval. Recipients then log on to the host network using a password to access the information for downloading. Features of the system include tracking and audit trails, search engines by category, calendars, diaries, recorded contact details and the management of formal correspondence, all with 24-hour access. The adoption of the system is discretional and depends on the duration and financial value of a project. If a client considers a collaborative system is viable, the name of the host provider is usually mentioned in the tender documents. This advises potential stakeholders of a client's intention to include a communicative system and for tendering companies to provide suitable training for staff, the cost of which must be included in the tender. For this reason, a collaborative system is suitable for projects where the cost of training is small in proportion to the value of the project. Some host providers for the construction industry can be found on the following sites: www.aconex.com, www.4projects.com and www.dochosting.co.uk.

Project management planning

Construction project managers make use of Microsoft Project, a software programme designed to assist with the planning of time, resources, budgets and tasks on a project. Probably the most commonly-used format for a construction programme is a Gantt chart (named after Henry Gantt, American engineer and inventor of the chart), a horizontal bar chart used to identify project activities and the length of time it takes to start and complete a task. The chart also includes a critical path that follows the duration of activities to be started and completed before the next stage can commence. For example, a programme of works may state a requirement for electrical wiring to be run within partitions and walls. Here, the wiring must be complete before the partitions and walls are lined with plasterboard and the critical dates for starting and completing the wiring create the duration of the critical path. Programming information can be distributed via a hard copy or electronically by email with a scanned copy of the document attached. Alternatively, an electronic file created from the software programme can be issued via email as an attachment, as long as the recipient has Microsoft Project installed as it cannot be opened through any other source.

Cost management systems

These technical and powerful systems produce reports on the status of project expenditure and cost forecasts together with a variety of cost reports. Main contractors use these systems as part of project management reporting, where reports are produced following interaction between the contractor's accounts department and the quantity surveyor, usually on a monthly basis. Software is either purpose-made to include estimating, cost planning and accounting which focuses on a business's specific activities, or can be purchased off the shelf with standard management tools. Purpose-made systems are expensive to purchase and install and take time to produce whereas readily-available systems have become relatively inexpensive due to the growth of information technology and the number of cost management systems available from software suppliers.

Video and teleconferencing

Visual and audio systems permit people in different buildings or locations to communicate over the telephone in a live meeting with the option to link audio communication to a projector and screen for visual salion. The popularity and practical use of this system mean they are widely used in boardrooms, meeting rooms and auditoriums.

Webcams

Webcams can be used to video record construction activity with cameras placed in strategic locations on construction sites for optimum viewing. The use of webcams for office use has become outdated due to the high-quality teleconferencing equipment now available.

Conference displays

Illustrations, graphics, charts and text can,with the use of systems such as Microsoft PowerPoint, be used in a commercial presentation which displays information on to a screen. Presenters can navigate between files throughout the presentation and provide a running commentary. For maximum effect, it is usual for presenters to plan and prepare the information beforehand.

Forums

This is a type of networking which involves discussion groups where bloggers meet online and log topics of interest. Bloggers share ideas, raise subject matters and ask advice from other bloggers who leave their comments in response. The RICS has a forum where information is shared between members.

E-tendering

This tendering system is an electronic method of procurement that commences from an invite to tender through to an award of contract. It is paperless,

sustainable and uses quality control and audit tracking in the process. In general, it involves an administrator uploading tender documents to a host website to be downloaded by tendering companies. Completed tenders may be submitted on line or in person, with the preference usually stated in the conditions of tendering. Various levels of security and sophistication exist with e-tender systems for accessing documents and may involve an approach similar to a document communication system in project management. A main difference between the host web provider of a project management system and e-tendering is that e-tendering is usually via the client's own site instead of a collaborative on-line system.

E-tendering has advantages over a paper system as it reduces tender periods, is spontaneous and depletes the need for manually inputting receipt of tenders. To maintain procedural integrity, tendering companies may be requested to pay a fee or (non)refundable deposit to an administrator to cover the cost of the service.

Cloud computing

Clients may employ an architect to draw up a master plan for an office that includes space for a central server. A server backs up and stores information stored on computers in the event of hardware failure. Cloud computing is an alternative to servers where they are replaced with a cloud host which frees up office space. The term 'cloud' is a metaphor and represents a cloud in which a list of providers, such as Google or Microsoft, can be accessed from computers. The service is internet-based and a business rents capacity from a data centre online and pays for consumption generated in the cloud. A provider installs software and hardware in the hirer's office and upgrades the existing system as necessary. The hirer makes use of storage space in the cloud by saving data such as accounts, project files, emails, etc, which is charged by the provider under the terms of an agreement. A luxury of the system is ease of use, as amendments to the hirer's needs mean the system can be upgraded or downscaled to suit changes in a business's needs. The system is available for mobile computing including laptops, portable computer devices and phones. The omission of servers and freeing-up of functional space is an advantage as it can yield additional working or storage space.

Building Information Modelling (BIM)

BIM is the digital representation of a building in model form using three dimensional or greater images. These images create a visualisation of a building through the various stages of design, construction and occupational life which are displayed in real-time mode. The tools used for BIM during the design stage set the pathway to create a computerised system that stores everything from standard plans and 3D (or greater) drawings to planning documents, specifications and finer details of specified product components. This includes logging information of components to illustrate exactly where they are located in a building

once it is occupied for identification and maintenance purposes. In addition, BIM simulates construction processes that enable various items to be addressed, including sustainability issues for reducing waste and choosing the most cost-effective schemes. Images and presentations available include animations and a walk through of the building at different phases of construction showing virtual construction methodology and occupational stages showing business activities once a building is operational. This aids the process of managing data for facilities management and assists with estimating the running costs of a building.

Where BIM is required for a project, a BIM manager provides advice to the client and design consultants about their requirements for the system's operation and the features available. For the system to operate, software is installed which may involve overhauling existing hardware systems and this is usually carried out by a BIM manger or IT consultant. Changes or upgrades for compatibility may be expensive and staff training is required in order to gain the most benefit. The system has distinct advantages over traditional design approaches as virtual reality demonstration means there is no doubt about the images and function of a building, avoiding something that may be incorrectly perceived when viewing traditional flat drawings.

For the PQS, BIM permits measures and quantities to be calculated from 3D figures, which saves on printing and the time required for measuring trade works. With BIM, it is possible to quantify materials and assess life-cycle cost appraisals from 3D drawings that are otherwise unavailable with flat drawings. In the future, main contractors may become more involved in the process as the United Kingdom government has recommended BIM for public buildings which will impact contractors that provide design and build services. Here, a contractor will be expected to take over the early design produced by the government's designers and appoint their own consultants to complete the design. The main contractor's quantity surveyor will need training in the use of the system in order to produce quantities in a fashion currently restricted to the PQS.

BIM benefits the industry and client because it:

- Enhances health and safety requirements
- Improves communication
- Is collaborative and reliable
- Reduces the chance of errors
- Mitigates design and construction risks.

Disadvantages include:

- The size of the electronic files and storage required to retain information
- A lack of general understanding and training in the use of the system
- Incompatibility of software provided with an existing system unless users consider that the cost to upgrade is a financial investment.

Disadvantages are outweighed by the benefits over time as outgoings in early investment provide dividends for the future and involvement in future schemes.

1.9.2 Environmental issues

A major influence in the preparation of a construction design and specification is environmental issues. This has brought a new thought process to the way buildings are designed, constructed and managed through their occupied life. This change in attitude has resurrected words that would otherwise be obsolete from industrial vocabulary and turned them into pertinent buzzwords. They include conservation and sustainability in construction which, combined and in general, is the capacity to protect, endure, maintain and support resources through the building process and occupational life of a building. Arguably, the impetus for a call to change has been at a political level, after the hole in the earth's ozone layer was discovered which was brought about by the use of chlorofluorocarbons (CFCs) used in many industrial processes. Fortunately, this has been controlled by subsequent legislation and regulation with degrees of success. However, the situation has been accentuated by an increase in global warming brought about by carbon emissions. The source and quantity of emissions and the effect on global warming have prompted radical thinking from a range of industries with the consensus to act responsibly and show consideration for the environment. The construction industry has recognised the problem and contributed to the control of environmental impact whether by organisational practice, customs, client requirements, law or contractual requirements, and has adopted trends and practices that form part of environmental business jargon.

Green business

This term expresses a company's policy regarding its commitment to cancelling any negative environmental impact during business operations at local and global level with a view to safeguarding community, business and society.

Green certification

In 2003, the European Union (EU) issued a Directive for member states entitled COM 2002/91/EC: Directive on the Energy Performance of Buildings. The legislation calls for energy savings in buildings to reach a benchmark reduction in greenhouse gas emissions of 20% by the year 2020 in comparison with benchmarks set in 1990. The directive places the onus on states to adopt common methods for calculating energy performance of new buildings and any building undergoing major renovation. The British response to the Directive was the introduction of the Housing Act 2004 and Housing Act (Scotland) 2006 together with the use of Energy Performance of Buildings (Certificate and Inspections) (England and Wales) Regulations 2007 and the Home Information Pack (No 2) Regulations 2007. This legislation makes it mandatory to display

Energy Performance Certificates (EPC) in new residential buildings (or those for sale or rent) and Display Energy Certificates (DEC) for public buildings. Certificates are graded as A (best energy efficiency and lower running costs) to G (least efficient and higher running costs) with the average being D.

In 2011, the United Kingdom government pledged an improvement on greenhouse gas emission reductions to around 50% by 2025 with views to cut this by 60% by 2030 and 80% by 2050. This courageous move means that the United Kingdom is the first country in the world to commit to reductions in the 2020s. However, a get-out clause has been set up to see how other EU members stack up against current emission reductions; the government may review the outputs, the presumption being it cannot go it alone.

Introduction of legislation and certification requirements underlined prior accomplishments of BREEAM (Building Research Establishment Environmental Assessment Method). BREEAM was established by the Building Research Establishment (BRE) and is the voluntary measurement for assessing the environmental impact of a range of building types for the use of clients, developers, designers or persons interested in the environmental aspect of buildings. BREEAM assessments include suggested methods for reducing running costs through the whole life cycle of a building and provide innovative assessment tools for guidance, the goal being to achieve a minimum impact on the environment. Certification is possible with the use of templates containing benchmarks, with a scoring system for ideas and standards that can be included in the design of a building.

Green certification schemes also exist in Australia under the control of the Green Building Council, and in the United States (and others countries) with LEED (Leadership in Energy and Environmental Design). LEED was developed by the US Green Building Council and is a private non-profit trade organisation that promotes sustainability in buildings with regards to design, the construction process and occupational use.

Sustainability

This broad term refers to the activity of any business which participates and promotes Green Business by having an environmentally-friendly attitude. The theme of sustainability ensures work processing and product manufacturing address environmental concerns whilst the organisation maintains a business profit. The objective is to meet the 'triple bottom line' that refers to people, planet and profit as discussed in the Brundtland Report, published by the United Nations World Commission on Environment and Development.

Sustainable materials and buildings

Part of Green Business policy promotes specifications that seek to control the use of natural materials and to promote the use of recycled products as an alternative. This is to sustain resources by keeping them in their natural habitat, e.g. specifying timber products produced from trees that, when left in their

environment, will clean the air and reduce pollution to make it more breathable. Recycling is possible for a number of building materials, including aggregates, metals, glass and papers that, when recycled, produce new products as an alternative to natural resources. For example, suitable crushed and graded inorganic demolition debris can be used as aggregate for the production of concrete instead of quarried products obtained from natural resources.

Sustainable buildings use performance and descriptive specifications that embrace insulation, water storage and reticulation, acoustics, efficient heat exchangers, heating systems and solar panels. The additional cost for including sustainable measures in a new building ranges from 2–5%. However, this is influenced by specification criteria and should be viewed on a case-by-case basis as projects will vary. In general, the higher the financial value of a building, the more attractive sustainable buildings are, because the add-on prices become less significant.

Life-cycle costs

A client venturing into a construction project may express a need to satisfy environmental matters, yet has concerns about the additional costs to construct a building and the expense of maintaining, heating and cooling once it is occupied. This is possible to address with a life-cycle cost assessment. The assessment is usually carried out by a PQS or specialist consultant and is a critical analysis of a full building design or part thereof that compares construction expense with benefits. A completed assessment will demonstrate how cost premiums included in a design can provide benefit to a building through the anticipated life cycle and provide a return on investment. For example, let us say the façade treatment of an office building is not decided; the options for walling between windows are for glazed cover, stone panelling or metal cladding and the client wishes to understand what benefits could be provided, other than aesthetics. This could be appraised by firstly assessing each option with its capital costs, i.e. the cost to supply and install, plus the maintenance and replacement charges over a given length of time. A period of 20 years would be an ideal duration as this is a reasonable length of time before a full replacement is required. The collation of capital cost for each option would be offset on a yearly basis by a reduction in energy consumption that would vary with each façade option because they have different insulation values. The options would provide the owner with a snapshot of the cost to install, maintain and replace in comparison with energy consumption costs for each façade through the life cycle.

Life-cycle assessments are figures orientated and are not conclusive, but provide an indication to the value of a building beyond a price to build. This is because any financial awareness is linked with environmental aspects and the rewards they may deliver. The perception of a building may be one that is enhanced if it receives certification for Green Business as it may mean the corporate profile and reputation of the building become salient. This will then help

to promote interest from tenants or purchasers who place environmental issues high on their list of priorities.

The subject of life-cycle appraisals extends to whole-life costing that includes a 'cradle to the grave' assessment of assets, whether a building or a component of a building. If life-cycle factors are a consideration, they should be addressed with options as early as possible to aid the design process, as afterthoughts involving redesigns could cost time and money.

Waste management

It is estimated that the United Kingdom construction industry produces one third of all waste generated in the country as a result of demolition, excavations and surplus product waste created during the construction processes. To mitigate this and make creators of waste aware, a landfill tax is levied by the government on waste disposal fees, with the funding generated used to pay for long-term plans dealing with environmental impact. The levy is charged by weight and for the type of waste disposed, i.e. if it is active or inactive, with varying rates applying. For this reason, there are two main benefits to a contractor for managing and reducing waste during a construction project. Firstly, a reduction in the estimated waste allowance included in a contractor's budget will save the contractor expense on disposal fees. When a contractor submits a tender, an amount of material waste in comparison with the installed quantities is allowed for risk due to working, cutting to length, damage, etc, e.g. an additional 5% for timber, 15% for face bricks, and so on. If a site supervisor orders materials to a value that exceeds the allowance, it will result in a financial loss to the contractor which is not usually recoverable from a client. However, it may be possible to avoid the burden by implementing waste management strategies that aim to reduce waste and save on disposal fees. This management style involves a policy of ordering materials for 'just in time deliveries' where goods are installed as soon as practically possible after delivery. For maximum effect, the provision of adequate storage and protection of unfixed materials are required as well as the careful planning of site activities. Secondly, the inclusion of a Waste Management plan on a project demonstrates commitment to the environment that also raises corporate image.

In England and Northern Ireland, the client has a duty to provide a system of management to demonstrate how waste is dealt with. This is legally enforced by the Site Waste Management Plans Regulations 2008 and Site Waste Management Plans Regulations (Northern Ireland) 2011. Although not legally enforceable in Scotland or Wales, creation of a site waste management plan is recommended by NetRegs, a partnership body that provides free environmental guidance for small- and medium-sized businesses. The Regulations make it mandatory for a client to provide a Site Waste Management Plan (SWMP) for construction projects valued in excess of £300,000. In practice, the contractor prepares the plan and the client and contractor are jointly responsible for its implementation. At the core of the plan are the contractor's methods for management that require

a statement of the type and quantity of waste to be produced and strategies in place for its handling and disposal. A declaration must be completed stating that the client and contractor (who is referred to as the principal contractor) will take reasonable steps to ensure waste materials are handled and managed in accordance with the Environmental Protection Act 1990 and Environmental Protection (Duty of Care) Regulations 1991. The plan is updated as the project develops, and it is enforceable by local authorities and/or the Environment Agency if intervention is required, with penalties applying if procedures are not followed.

The contractor's quantity surveyor must show an interest in waste management as it can affect budgets and profit margins. Effective measures for limiting waste disposal include compacting and breaking up bulky items and placing them into skips. Furthermore, when dealing with excess spoil generated from earthworks operations, it is wise to accommodate the material on site by spreading and levelling the material around low levels of land and compacting in layers. This process is used by developers during new housing construction on green (new) or brown (reclaimed) land where topography permits innovation with ground levels. If low levels of land are unavailable for filling, an option is to raise the level of a building by a nominal height and fill the low areas created. This option requires the quantity surveyor to carry out a cost exercise by assessing the additional cost for varying the construction works. This additional expense is offset by the reserved budget allowance for loading, hauling and disposing the waste. If proved viable, the method will require approval by a person in authority to ensure any increase in building height is practical and complies with planning approval. Furthermore, any filling works are subject to approval by the engineer and contractor who must consider handling of the material if it is hazardous and capping the fill with inert material if required.

Lean construction

'Lean construction' is a term coined in the 1990s by the International Group for Lean Construction, and refers to the use of good practices in end-to-end processes. This lean approach aims to continuously improve standards, minimise cost and maximise value whilst maintaining a client's needs. The strategies commence from design and continue through the construction phase to limit maintenance works after a building is occupied. One theme of lean construction is to limit waste by using proactive management that seeks flawless behaviour by improving communication and using procurement with strong supply chains, which is influenced by environmental bodies and governments. The ideology focuses on holistic pursuits of the built and natural environment including design, construction, activation, maintenance, salvaging, recycling and concurrent improvement of each process. It has aims of a 'Master Builder' concept not restricted to environmental issues and applies a lean theme for minimising time and efforts in the process.

1.10 Prospects and augmentation of the quantity surveyor

1.10.1 Employed roles

Is a quantity surveyor an estimator, contract administrator or a project manager? The short answer to this question is yes, yes and yes. People from a quantity surveying background may find a working environment compatible with any of these roles because the training and qualifications acquired from quantity surveying create the pathways. It is up to the individual whether they wish to divert and specialise and, if electing to do so, must commit to acquiring the required skill sets. In order to obtain the desired skill set, there is need to distinguish the differences as each discipline requires separate skills and levels of responsibility.

Estimator

It is worth understanding the difference between an estimating service provided to a client as advice and the estimating process required by a contractor to secure work. The PQS provides a cost planning service for a client in the capacity as consultant. In this capacity, an estimate of probable cost to construct a project for budgeting purposes is issued to a client, possibly in the absence of a design or with only sketch proposals, which is monitored whilst the design is developed. It is a cost management role to advise the client's team of cost forecasts until the design and documentation are suitable to invite tenders from main contractors. A main contractor's estimator may be a quantity surveyor who prepares a cost estimate based upon the tender documentation. Once the cost estimate is complete, a sum is added to cover business overheads and profit which converts the estimate into a tender and an offer to carry out the works. Ideally, the PQS's final estimate of probable cost should be similar to the tender prices received. If there is a discrepancy between the advice given by the PQS and tenders received for the works, it has nothing to do with the main contractor's estimator and is a matter for the client and client's team.

Contract administrator

Contract administration refers to post-contract activity and deals with commercial and contractual matters, procurement and cost management of live construction projects. In the United Kingdom, quantity surveyors are engaged as contract administrators by a PQS practice, main contractors and large subcontractors, each responsible to their respective project manager or team leader. Incumbents, who are usually employed full time to administer one or a number of concurrent schemes (depending on their size and complexity), usually go under the title of quantity surveyor or contract administrator. In Australia and a number of other countries outside the United Kingdom, the title quantity surveyor is used solely with reference to the PQS and individuals carrying out commercial activities on live projects for a contractor or

subcontractor are referred to as contract administrators. One main reason for the distinction is the British tradition of including a bill of quantities as a contractual document in some procurement routes, which warrants its inclusion in quantity surveying and building degree courses. The general view taken in some countries outside the United Kingdom is that a project bill of quantities is not a contractual document and, if available, is for reference only. Therefore, the consensus by some is that the skill of measurement and bill of quantities production is specific to the PQS. It is therefore considered an integral part of a quantity surveying degree course and included to a lesser extent in construction management degree courses.

Project and commercial managers

A project manager engaged by a client acts as an agent of the client and addresses matters required for the successful delivery of a building project. On large projects, a client may engage a project management company under the control of a project director. The project director does not carry the legal status of a company director for a project because a project is not usually a business. However, a project director may be a director of a project management company that supervises an in-house team to oversee a scheme. The scope of services provided by a project management company broadly includes:

- Obtaining planning permission
- Preparing a project brief of key requirements
- Recommending appropriate consultants for appointment
- Budget setting
- Procurement selection and monitoring development of the design
- Selecting contractors to tender the works and vetting tenders received
- Negotiating the terms and conditions of a construction contract and advising the client
- Overseeing construction of the works to completion.

Project managers employed by contractors provide working programmes, technical and contractual advice for staff and accept responsibility for delivering a scheme to a client on behalf of the contractor. They also provide feedback from committed projects to identify risks that influence commercial decisions for works under tender. Contract administrators and quantity surveyors may benefit a contractor's business because of their commercial awareness, and incumbents in this capacity often excel to the role of a project manager.

Commercial managers have varied roles that focus on commercial activities of a business including:

- Marketing and business development for company expansion
- Contract negotiations including reviewing conditions of pending awards
- Property management

- Supply chain management including vetting and administration of their contracts
- Cost managing projects
- Management of business overheads.

Large companies undertaking a number of concurrent projects may engage one or more commercial managers to oversee a group of people. When employed in this capacity they are usually responsible to a director for commercial activities and may have extensive legal training, specialising in contract law. With smaller companies, the commercial manager would normally be responsible for tasks themselves and be aware of strategic functions of the business.

1.10.2 Independent roles

Some people seek flexibility and diversity in their career for personal reasons or may have other commitments, and employers can offer a solution to this with short-term contracts. These contracts benefit employers when particular tasks require completing to fill short-term needs and may also suit independent contractors who do not wish to commit to full-time roles. The independent role benefits the quantity surveyor, estimator, contract administrator or project manager who is already qualified and wishes to train for other qualifications that are otherwise hard to achieve for a person employed full time. For example, a main contractor may require a quantity surveyor to prepare variation claims or assist with awarding trade packages when permanent staff members are on leave, and the arrangement is suitable for a quantity surveyor who may be training for another field of work.

Individuals may seek supplementary fields of work to their career and make use of short-term employment opportunities to provide income whilst undergoing training. The combination of existing qualifications and experience is the prerequisite for creating new skill sets, and a choice of supplementary roles that may become available once a skill set is learned and accredited includes:

- Statutory adjudicator for assessment of payment disputes in construction contracts as legislated by the Housing Grants, Construction and Regeneration Act 1996 and Local Democracy, Economic Development and Construction Act 2009
- BREEAM Assessors of Quality Assurance certification
- Book writing
- CDM coordinator.

The key to independent working is reliability, good communication and being organised, together with proven experience and marketing skills. The downside is the lack of permanent job security, no entitlements for holiday leave or career progression in a company. On the upside, independent roles provide opportunities for alternative career paths and a choice of commitment.

1.10.3 Women in the industry

In the United Kingdom, women represent approximately 10% of construction industry workers. The orientation of building work has meant most blue collar workers are men, with the few exceptions being women who enrol on certain craft skill courses. Most women workers are white collared professionals, including project managers, engineers, interior designers and quantity surveyors. In the interests of women, the National Association of Women in Construction (NAWIC) was chartered in the United States in 1955 as a not-for-profit organisation. Since its formation, the association has expanded with affiliations in Canada, Australia, New Zealand, South Africa and the United Kingdom. Primary objectives of the association are to raise the profile of women working in the industry, promote cooperation as a positive instrument for change, and provide a support and networking arrangement. Membership is made up from occupation sectors that include sales and office staff, professional and management positions, roles associated with natural resources, construction, maintenance, service occupations and the transportation and delivery of materials. With the expansion of recruitment businesses specialising in the appointment of both male and female co-workers in construction and engineering, women engaged by such recruitment companies are also considered women in the industry and may apply for membership. Benefits of membership include social and industrial networking, access to members' databases, the opportunity to campaign for better deals for women in the industry and participation with industrial research. NAWIC differentiates itself from other industry groups as being an outward-facing organisation first and foremost with a force for change that makes a construction career an attractive option for women.

1.10.4 Global and multicultural diversity

Although quantity surveying is British in origin, it has expanded globally, with Australia, Canada, Jamaica, Kenya, Malaysia, New Zealand, Nigeria, Singapore, South Africa, Sri Lanka and the Pacific/Asia region all having Institutes of Quantity Surveyors. The creation of these institutes permits the possibility for members of the RICS to hold dual membership, which helps to bridge cultures and formally recognise quantity surveying education and training as a global network. Suitably qualified professionals may travel overseas for reasons such as personal development or adventure which can be a rewarding experience and, while doing so, aid their career progression. A qualified individual with a degree who wishes to work overseas would be encouraged to seek chartered status of the RICS as it acts as a stepping stone to obtaining an overseas qualification. Prior to obtaining the overseas qualification, the individual may be required to undergo a probation period to assess their competencies and understanding of national practices that may differ from their home country or country where the education and training was gained. Advantages

of membership in a host country include access to cultural and working practices through networking and advice on licenses to work. Members may belong to local affiliations or chapters which apply in large countries such as Australia and Canada. These countries have states, provinces and territories with subtle differences in working practices between regions, and membership provides access to affiliate or chapter networks in order to understand the variances. Reciprocal agreements between institutes confirm core training and education. However, it is important for anyone making the move to understand nuances in order to adapt culturally.

The demand to work internationally depends on a country's political and migration policies which control the number of visa work permits available at any time. This is influenced by the national economy of the country as well as employment supply within the home-grown workforce. This is subject to periodic change at political level that drives demand and the need to fill skill shortages in particular industries.

1.10.5 Prospects

The role of quantity surveying has expanded from one of traditional core principles involving measurement and the pricing of building works to one of broader involvement in the construction industry. There is a demand for quantity surveyors who may wish to diversify into various roles as discussed in this chapter, and individuals are encouraged to seize the opportunity and work in their chosen field. The construction industry changes at a fast pace and with the growth of information technology, environmental issues and project procurement methods available, there is a need to share ideas that benefit employee, employer, client and the industry. Although the profession has strong traditional values that have stood the test of time, it is encouraging that the future certainly appears to warrant the continuous need for the quantity surveyor, albeit manifesting in a number of forms.