GUIDE TO QUALITY MANAGEMENT
IN THE CONSULTING ENGINEERING INDUSTRY

Electronic Edition

FIDIC

FIDIC is the International Federation of Consulting Engineers

FIDIC was founded in 1913 by three national associations of independent consulting engineers within Europe. The objectives of forming the federation were to promote in common the professional interests of the member associations and to disseminate information of interest to members of its component national associations.

FIDIC membership presently numbers over 60 countries from all parts of the globe. The federation represents most of the private practice consulting engineers in the world.

FIDIC arranges seminars, conferences and other events in the furtherance of its goals: maintenance of high ethical and professional standards; exchange of views and information; discussion of problems of mutual concern among member associations and representatives of the international financial institutions; and development of the engineering profession in developing countries.

FIDIC publications include proceedings of various conferences and seminars, information for consulting engineers, project owners and international development agencies, standard pre-qualification forms, contract documents and client/consultant agreements. They are available from the secretariat in Switzerland.

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Preface

Throughout its history, FIDIC has exercised its mandate in the production of various documents, contract forms, guides and manuals to assist Consulting Engineers worldwide to perform and deliver services to their clients. These publications have facilitated the business practice of Consulting Engineers to establish standards or norms which are used by a large and increasing number of Consulting Engineers and their clients.

Some of the documents, for example, contract forms, are very specific, while others are more of a guideline. All of the FIDIC products have benefited from the contributions of a number of members, in their production. The present Guide is no exception.

The first edition of this Guide was issued in 1994 and was prepared by a committee chaired by R.W. Bowes. A significant contribution to the production of the first edition of this Guide was made by Tom Kern of the American Consulting Engineers Council.

The present edition of the Guide has been prepared and edited by FIDIC's Quality Management Committee under the chairmanship of Tonny Jensen, Denmark. Significant contributions was made by David Shepherd, Australia, Frank Leblanc, Canada, and Ben Novak, Canada.

The Guide has been developed as a living document, subject to periodic review and updating in order to provide Consulting Engineers with comprehensive documentation on Quality Management. The document will be supplemented and enhanced as more experience is gained in its application.

This Guide sets out reasons why Consulting Engineers should apply Quality Management in all of their work, and provides an introduction to initiating this Quality Management process in their firms.

The development of a Quality Management System in many firms will often be accompanied by improved business practices designed to enhance the quality of business management. Firms and Member Associations are encouraged to take advantage of the *FIDIC Training Kit on Quality Management*, and of the professional seminars and extensive amount of published material offered by FIDIC and others on the general subject, and to customise the material for their own specific requirements. For further information, reference is made to Appendix E.

FIDIC would be pleased to receive feedback from the users of this Guide on its usefulness, and areas for improvement.
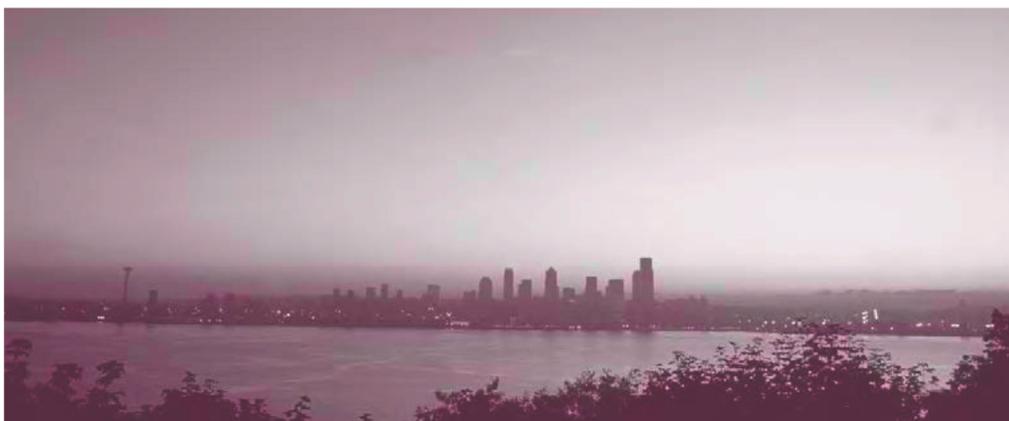
1   Introduction

1.1 Purpose of the Guide

This Guide has three main purposes:

1 To provide background information on, and an introduction to, Quality Management, with convincing evidence that member firms must adopt effective Quality Management practices, focussed on continuous improvement through the involvement of all employees.

2 To outline what constitutes a Quality Management System for consulting firms.

3 To outline what steps to follow to initiate the development of a Quality Management System in a consulting firm.

1.2 Quality, historically

In every age there has been a demand for conforming products. For simple, single component products, the purchaser or user could readily determine the extent to which a product met requirements. With increasing complexity and numbers of components, it ceased to be practical for the ordinary purchaser to assess conformance by simple inspection methods, and reliance was placed on the integrity of the producer. In small communities, the producers would all be known, and reputations would be quickly established.

Communities became larger and population mobility increased. Products made outside the community became increasingly available, and the identity of the maker often became indiscernible. An alternative basis of assessing quality was needed. The trade guilds provided a formal basis for the training of tradesmen, and regulated the quality standards of their products. This proved very satisfactory for products that could be produced by a single tradesman with the aid of a few journeymen and apprentices.

For major products involving several trades and large numbers of workers, the system did not provide a satisfactory level of assurance that the desired quality would be met. Shipbuilding was a particular concern owing to the high cost in lost ships, cargoes and lives that resulted from product failure. Ship owners and the merchant users of ships were the first to establish what has become known as Quality Assurance. However, whereas the first ship classification society was established in 1748, it took another 90 years before 'survey under construction', as opposed to final inspection, became the basis of assessment.

The mass production of multiple component products set the scene for the advent of the modern quality discipline, that effectively dates from the work of Walter Shewhart at the Bell Laboratories in Chicago. Dr. Shewart's methods were first introduced into Europe in 1938, and into Japan by W Edward Deming and Joseph Juran in the 1950s. Scientific method, using the principles of probability and statistics, has been the cornerstone of the stunning advances in world product reliability. Philip Crosby has led a parallel approach, sometimes seen as an alternative to the Deming method, that focused on the positive influence on quality of individuals conscientiously and systematically removing error from their work.

The pursuit of world harmonisation in standards, and the removal of barriers to international trade, has led to the International Organization for Standardization (ISO) publishing a group of standards on quality systems collectively referred to as the ISO 9000 Family of Standards. The first edition of these documents, substantially based on British Standard BS 5750 - 1975, appeared in 1987. The ISO 9000 Family of Standards has become one of the most widely published standards in the world, and has been adopted without editorial change by over 75 countries.

The short form of the International Organization for Standardization is 'ISO', and not 'IOS'. ISO is in fact a word derived from the Greek isos, meaning equal, which is the root of the prefix iso- that occurs in a host of terms such as isometrics - of equal measure or dimensions - and isonomy - equal of laws, or of people before the law. The name has the advantage of being valid in each of the organisation's three official languages - English, French and Russian - and avoids the confusion that would arise through the use of an acronym that would not correspond to the title of the organisation in French.

The term Total Quality Management (TQM) was coined in 1985 by Nancy Warren, a psychologist

1   Introduction

with the United States Navy. It was introduced as an alternative to the Japanese Total Quality Control. The significance of TQM is that it requires an organisation to apply quality principles to all aspects of its operation, not just those concerned with production or services. Aspects of the organisation often excluded from the quality system, would be included in a TQM system, such as financial management, human resource management, marketing and sales, information technology, and general and executive management of the enterprise as a whole. Further, TQM focuses on continuous improvement involving all of a firm's employees.

1.3   The concept of Quality Management

For a firm to be successful, their services and products have to satisfy three sets of needs - those of clients, those of society and those of supplying organisations. In order to meet these needs, management of quality can be expressed in the words 'getting things right from the beginning, every time'.

Quality must not be mixed with 'grade'. A quality service or product is not necessarily of high grade. Quality fulfills wishes/needs/requirements, which can be of low or high grade.

Further, one has to realise that quality cannot be checked or inspected into a service or product. Quality must be designed into the service or built into the product as part of the process. Thus 'getting things right from the beginning, every time' is the result of processes. Quality Management is concerned with the processes leading to the service or the product - recognising that if those processes are correct, then the service or product will be correct. Quality Management is about identifying these processes, and controlling them.

Another important aspect of Quality Management is the concept of improvement. History has shown that in any process there is always room for improving the efficiency of the processes, or for obtaining a higher grade with the same resources. The involvement of all employees in the continuous improvement process is therefore an integral part of Quality Management.

1.4   Kaizen

Although Kaizen is a Japanese concept, many organisations have adopted its systematic common sense with great success.

The word 'Kaizen' combines the Japanese characters Kai, which means 'change', and Zen, which means 'good', and translates roughly as 'continuous improvement'.

According to Kaizen, progress is achieved less through momentous, single leaps forward than via unceasing small changes to the many little details associated with achieving a desired end result

Kaizen has 10 principles:

Focus on customers
Make improvements continuously
Acknowledge problems openly
Promote openness
Create work teams
Manage projects through cross-functional teams
Nurture the right relationship processes
Develop self-discipline
Inform every employee
Enable every employee.

Experience shows that the most vital determinant in achieving lasting and continuous improvement is the attitude and behaviour of the people involved. This may mean a significant change in corporate culture.

2 Quality management in consulting engineering

2.1 FIDIC and Quality Management

The practice of consulting engineering has evolved and grown to become a major industry worldwide because individuals have placed a priority on producing work and services of the highest quality standard. Given the complexity of major projects, this has been accomplished through the application of systems to co-ordinate the input of the many professionals involved. The large number of consulting firms that have prospered for many decades is evidence of achievement in the performance of quality services.

Today, as a condition of awarding work, an increasing number of clients require assurance that consulting firms operate a formalised Quality Management System within their practices. A number of FIDIC Member Associations have responded to this trend by developing documents to assist their members formalise Quality Management in their practices. FIDIC member firms generally agree that an active Quality Management System directly enhances business results. Quality means Business.

FIDIC chooses the term Quality Management on purpose. Quality Management, as opposed to quality control or quality assurance, most accurately reflects the all-encompassing importance of quality and its application throughout an organisation's entire operation. Quality, according to ISO, is 'the ability of a set of inherent characteristics of a product, system or process to fulfill requirements of customers and other interested parties'. Quality control and quality assurance are elements of Quality Management. Although helpful in improving the quality of services and products through checking, inspection and standardisation, on their own, they fail to consider the holistic implications of all elements of management on an organisation's services and products.

FIDIC believes that an emphasis on the customer's satisfaction, and continuous improvement through involvement of all employees, is essential for a successful organisation.

This concern for all features and characteristics of a product, service, organisation, etc., explains the importance of having a quality orientation for all management activities. Quality Management seeks to satisfy all customers - internal as well as external. Quality Management also seeks continuous improvement at every transaction point along the way toward the delivery of the services and products offered by the firm.

Every organisation deals with a number of interested parties. Each interested party has diverse needs and expectations, and expects its own benefits from positive trends in the organisation. It is important that a firm understands, analyses and acts on the needs of the relevant interested parties.

The Quality Management System that a consulting firm must develop and put into everyday practice may require an important cultural shift in thinking throughout the firm. A vital prerequisite to success is the total support of senior management in thought, word and deed. It must become 'the way we do things around here'. The achievement of this mindset and 'way of working' may require continuous training throughout the firm, with all employees focussing on 'customer satisfaction'.

This document does not refer to a particular Quality Management Standard.

Various Quality Management Standards exist. The International Organization of Standardization ISO 9000 Family of Standards are the most commonly used Quality Management standards. How to interpret these standards for consulting firms is described in the *FIDIC guide to the interpretation and application of the ISO 9001:1994 Standard for the Consulting Engineering Sector (1st Edition, 1997).*

2.2 FIDIC policy

FIDIC has developed a policy statement to assist all Member Associations and their member firms in the pursuit of their commitment to quality. This statement should be read in conjunction with FIDIC's other policy statements, in particular the policy statement on consulting engineers and the environment.

FIDIC recommends that:

Member firms must have a commitment to excellence through the implementation of a Quality Management System involving all levels of management and every employee, focussing on continuous improvement.

FIDIC also recommends that:

a   Member Associations should assist member firms in developing Quality Management Systems by providing guides, training and general support.

b   Member firms fulfill the requirements of the ISO 9001 Standard, taking into account the FIDIC Guide to the Interpretation and Application of the ISO 9001.

c   Member firms have access to an independent evaluation of their Quality Management System, within guidelines developed by the profession, in collaboration with client groups and/or internationally accredited certification bodies with proven experience in auditing consulting firms.

2.3 The eight principles of Quality Management

ISO has identified eight Principles of Quality Management. Each of these principles is a comprehensive and fundamental rule or belief, for leading and operating an organisation, aimed at continually improving performance over the long term by focussing on clients while addressing the needs of all other interested parties.

The adoption of these principles by a consulting firm will be a necessary precondition for achieving a Quality Management System within the firm. The principles apply to firms of all sizes. The eight principles are explained below in the context of consulting engineering.

1 Customer-focused organisation

Customer satisfaction

Customer satisfaction is the primary focus of Quality Management. A proactive pursuit of customer satisfaction is a critical element. Management and each employee must learn the concept of internal and external customers. Not only is there an external customer - the client - to be satisfied, but along the way as each person passes work to the next, the concept of the 'next person as a customer who must be satisfied' must be cultivated. That means finding out what the customer, i.e., the next person next in line, wants or needs, and then delivering the required quality.

Without the external customer - the client - the consulting firm cannot remain in business. Quality Management adds value for the client. This is why Quality Management focuses on the needs and wishes of the external customer.

Quality Management practices increase the understanding and communication between the consultant and client, leading to clear and achievable expectations of the service and product, that the client receives.

Of key importance is the definition of all the individuals in the firm as internal customers of the intermediate products and services that contribute to the generation of the final product for the external customer. Defined in this way, all individuals in the firm deserve treatment as customers. If individuals in the firm are to treat one another as customers of the products and services that they provide, empowerment, trust and a positive work environment become essential.

A Quality Management philosophy focusing on customer satisfaction and continuous improvement will contribute to delivering value-added services to the clients.

This client-driven process is illustrated in the figure below.

Client relationship

The client relationship begins well before project inception. The project proposal phase, pre-project relationship, and pre-contract activities are crucial to a close working relationship, and the development of trust and confidence. This relationship should be maintained
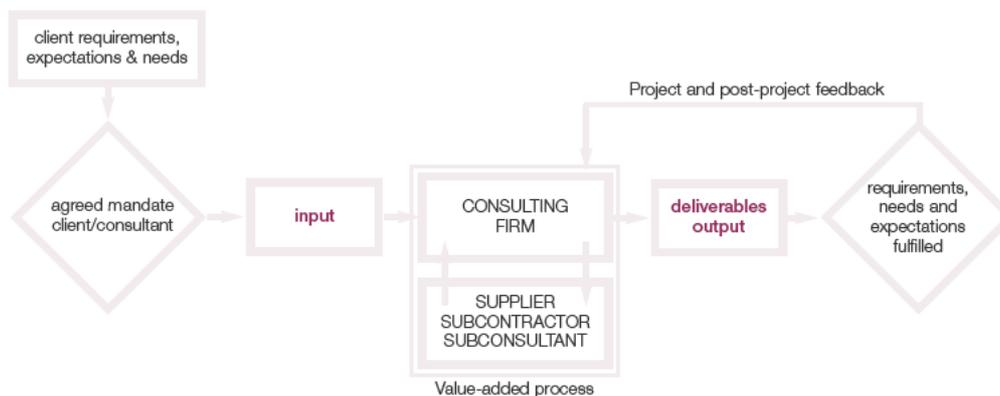
The client-driven process

and further developed during the performance of the service. Understanding the client needs, what the real project objectives are, who the real clients are, and what all the expectations are, constitute essential steps in achieving quality.

2 Leadership

Top management commitment

The Chief Executive Officer (CEO) of the firm must demonstrate in a clear and visible way that he or she is fully committed to Quality Management. This commitment must be evident to all staff in words and actions. The CEO must lead in the initial steps, in the formulation of the vision and in the allocation of resources to the Quality Management initiative. Most importantly, the CEO must demand that the Quality Management System be adhered to, and design the corporate compensation programme to recognise commitment. There should be no misunderstanding that the top management of the company demands quality, and is prepared to take the necessary actions that will remove barriers for achieving quality.

Proactive leadership

Proactive leadership emphasizes consistency of purpose through a clear, shared vision. It stems from strong, principle-centred governing values that reflect the culture of the firm. Proactive leadership is a style of management that utilises empowerment. Empowerment focuses on relationships and achieves success through the efforts of others, by delegating and giving staff responsibility, and the authority to act.

A visionary plan for implementation

A firm's leadership must develop an implementation plan in order to have a blueprint for the achievement of its purpose. Among its tasks are to:

- establish the quality policy for the firm
- acquire knowledge of quality
- arrange and bring about total staff involvement, including their roles in meeting the firm's environmental responsibility
- improve its communication and information systems to generate and drive data to meet needs
- develop a service-oriented plan
- arrange a client-driven delivery system.

These last elements address the needs of the client, the recipient of the firm's services and products. This level of attention is required in order to ensure that mechanisms to satisfy the client receive priority.

3 Involvement of people

Employee involvement

The involvement of every employee is critical to the successful implementation of Quality Management in a consulting firm. Every task in the day-to-day operation of a firm, and in the conduct of professional services, includes people who have to commit to quality and seek it out in their responsibilities. Unless all staff see themselves as an important part of the process, the potential benefits of Quality Management will not be achieved. Ongoing dialogue and training are vital.

Synergized system implementation

A firm should seek a synergy where the whole is greater than the sum of the parts in terms of staff involvement in the development and provision of products and services. This is an important element of Quality Management and explains why attention is paid to it. Synergy generates success beyond the individually added contributions of staff. It can be developed by creating trust, a positive environment in which to work and empower staff, with the result that clients are delighted with the services provided.

Communication

Effective verbal and written communication is essential to the successful implementation of Quality Management in the consulting firm. The prerequisite for success of teamwork is that all parties involved, obtain and maintain the same understanding of the project, throughout the performance of the service. This requires proper communication and co-ordination.

Teamwork

The services of a consulting firm are usually the product of a team of people. Where that team functions together as a mutually supportive and synergistic unit, quality results may be expected. While individuals' efforts are important, it is the team effort that leads to success. The management must ensure that individuals understand this.

The working environment

The working environment refers to the macro environment in which the consulting firm operates, as well as the working environment in which the desired quality work is to be performed, and extends to all aspects thereof. Adequacy of resources in terms of personnel, hardware and software, are perhaps easy to understand. (Software would include quality systems, procedures, management commitment, time and cost budgets, in addition to computer software.) But there are a great many other items that together constitute the working environment. Lighting, the absence of noise, air, olfactorial, sound or visual pollution and ergonomic layout, all contribute towards the attainment of desired quality performance.

Recognition

What gets rewarded, gets repeated. The firm's management has to become identified with quality work: it must demand quality work, and reward its achievement. If less is acceptable to management, then that will be what is delivered. Management must strongly support continuous employee training, in the quality aspects of employees' responsibilities in addition to the conventional focus on technical training.

4 A process approach

Processes

Any output is the result of one or more processes. This means that if the processes are correct and performed correctly, then the service or product will achieve the desired quality. The identification and control of all processes influencing the quality are important activities. In a consulting firm, processes depend very much on the employees.

Process is the orderly sequencing of defined activities, some of which may be repetitive and thus guided by certain protocols and accepted standards. Others will have to be defined in the planning process, so that they can be adequately estimated and scheduled, and conveyed to the team for execution.

Planning

Assuring that the desired quality is achieved requires that adequate time be spent in planning the work to be done. Quality Management cannot function without effective planning.

Document and information management

In a consulting firm the typical sequence of activities is to collect data and information, process the data and information based on the experience and knowledge of the employees involved, and finally to deliver value-added information to the client.

The container for the information to the client is often documents in hard copy or databases. The availability of this information for the subsequent addition of complementary or sequential tasks, as well as facts related to the administrative management of these activities, must be available on a random basis. The storage and retrieval on a short- or long-term basis requires an organised and consistent approach.

We are presently in a period of conversion from paper to electronic media. Many storage issues will have to be addressed. The availability of valuable 'inventory' created by the work and management process is crucial to the firm's success and continuity. It must thus be part of the Quality Management System.

5 System approach to management

Identifying, understanding and managing a system of interrelated processes for a given objective improves the organisation's effectiveness and efficiency.

Consulting firms need to pay attention to interrelationships between project processes, project support processes (for example, quality, risk and information management) and administrative processes (for example, human resources, financial management and business planning).

6 Continuous improvement

The quest for quality in services is a journey. The most important step is the first one, but ongoing improvements are a product of a series of steps. Each team and each person must continuously examine their work, with a view to identifying more effective ways to achieve the desired service, including reducing the time and resources required and to improve the quality of the service.

The adoption of the 'Plan - Do - Check - Act' cycle can be beneficial in the process of continuous improvement.

The steps are:

1 plan by clarifying expectations, surveying existing conditions, developing and analysing courses of action, and planning the improvement process
2 do through testing the process
3 check by analysing the results, and
4 act by standardising the process and repeating the overall improvement process.

7 A factual approach to decision making

Effective decisions are based on the analysis of data and information.

Measurements

Quality must be measured for it to be managed. Measurements should be a means for determining results and developing methods to improve processes. The measurement process should be continuous rather than take place on a single occasion, and results should provide feedback into the various levels in the organisation. It is important to recognise that there is always room to improve, and to continuously build on previous improvements.

Appropriate methods must be developed to monitor the Quality Management System, and to identify corrective actions that may be required to enable continuous improvement of existing processes, or to meet the requirements of new, improved processes.

Auditing

Auditing is a process which subjects randomly chosen aspects of project work or management procedure to a detailed examination. If described protocols exist as a part of

an implemented Quality Management System, the defined conditions are monitored. The number of material departures from the defined norm are recorded, described and counted: this is the audit. Comments on ways to improve the audit may be added.

Management is made aware of the results, and must decide what corrective measures to implement and what resources to commit to the process. This is likely to be a business decision measured against the benefits.

Management review

The management of the firm should periodically analyse and review the Quality Management System, so as to assure its suitability and effectiveness and actualise its objectives. Management review should focus on measurable items, such as redesign incidents, unsatisfactory scope definitions between internal departments, refused extra work orders, project profitability and the like, as direct indicators of poor adherence to the procedures.

As a basis for the analysis, the following items should be considered:

- changes to the regulatory standards
- increments of scope in the services to be provided by the firm
- degree of achievement of the firm's actual quality objectives
- internal and external audit results
- non conformance
- customer complaints
- corrective and preventive actions.

Client or other external feedback

It is crucial for a Quality Management System to obtain external, or client feedback. This can be done through:

- Client evaluations: These may be solicited in a number of ways: first, by direct inquiry, and the cataloguing of comments into classified issues; second, through an easy-to-complete questionnaire. Finally, the most direct test relates to further work from a satisfied client, whose satisfaction is concretely demonstrated by extending a contract or re-engaging a consultant. The reasons for this confidence should be carefully established and documented, as they may vary from client to client.
- Benchmarking selected criteria of competitors, and perhaps other industries.
- Conducting follow-up debriefings on proposals, won or lost, and on projects.
- Commissioning an external audit, not necessarily for certification purposes, but to obtain independent evaluation of the Quality Management System, and opportunities for improvement.
- Peer review: This can assist the firm in identifying areas for improvements.

Prevention focus

Quality cannot be inspected into a product or service: it must be built or designed in at every step. The quality process facilitates the prevention of errors and wasted effort, and makes the vision of 'getting it right from the beginning, every time', a reality.

Careful attention to the pre-project and planning phases of a project has the potential to yield significant savings of time and cost. Errors or misinterpretation of the intent of a design, if not identified until the design is well advanced or actually into construction, are costly, and orders of magnitude more expensive to correct than to prevent.
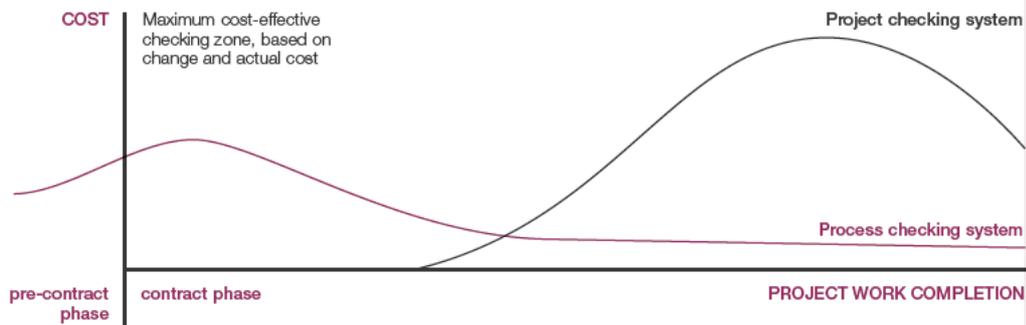
The figure opposite illustrates the typical sequence of a project, from award of contract to completion of the assignment. The checking system normally followed - so-called product checking - would allocate significant checking efforts later on in the project life, typically at a time when correction costs are high. The alternative checking system - so called process checking - would allocate significantly more effort to the early portions of the project life, even in advance of the contract. These early efforts would be spent in activities that better define the scope of work, clarify expectations, and resource requirements, and lay the groundwork for improved communication, all leading to a better understanding of what is required, and adequate budgets and resources to meet the requirements. Owing to the focus on error prevention at the very early stages, the process checking system leads to reduced project costs.

8 Mutually beneficial supplier relationships

For a consulting firm, mutually beneficial relationships apply particularly to relationships with sub-consultants and contracted organisations involved in the provision of the services. Mutual trust, knowledge of personnel capabilities and understanding of each others' quality cultures tend to be developed over time. In some cases, formal or informal alliances may be established, so that common processes can be used to improve effectiveness and efficiency. Long-term supplier relationships may also be of value in purchasing goods and services, such as information technology and administrative support.

COST

Maximum cost-effective checking zone, based on change and actual cost

Project checking system

Process checking system

pre-contract phase | contract phase

PROJECT WORK COMPLETION

Product checking versus process checking

2.4 Why consulting firms should adopt a Quality Management System

FIDIC believes that the practice of Quality Management by consulting engineering firms of all sizes is necessary for the industry's continued success and advancement. The basic principles articulated by Deming, Juran, Crosby, and others who advocate quality, elaborate on how a firm should do business if it wishes to achieve a quality orientation. Although these writers emphasize the importance of customer satisfaction as the principal driving force for achieving quality, a number of other reasons also justify the consulting engineering industry's widespread adoption of Quality Management.

Satisfied clients

Consistently satisfying clients is the primary benefit of a Quality Management System. Clients require assurance that the service provided will meet their needs. Firms should be able to provide this assurance. The consequence of a delighted client is more business. Quality means business.

Quality Management fundamentally improves our awareness of our clients' objectives from the beginning, assures that procedures are in place for controlling and verifying the service, and ensures that the clients' performance criteria are met.

Effective client satisfaction surveys and feedback systems ensure that the firm reviews the processes that proceeded correctly, as well as those that could be improved in the future.

Trust that takes years to establish, and minutes to destroy. The result of poor quality reaching the client can seriously damage client relations. A client's trust in a firm's services is therefore very important. This trust will also help maintain client loyalty, and possibly provide greater opportunity for repeat business, and client-generated references or endorsements.

The business environment

Competition across international borders, and the way in which firms outside the engineering industry have positioned themselves to offer engineering services, pose new challenges to the traditional, local consulting engineering firm. This challenge exists regardless of the size and geographic orientation of the firm. It challenges firms to revisit their management and operational style, if they wish to stay in business and compete within their market and local niche. It is FIDIC's view that this competition is healthy. Competition can lead to the consulting engineering industry's own advancement by improving management, products and services to survive and thrive in the changing marketplace. Such a development will be to the benefit of clients, society, the environment, and the firms themselves.

More and more government agencies and private owners require that a Quality Management System be in place, as a prerequisite to hiring consulting engineers. Firms should recognise this trend, and prepare a Quality Management System in advance.

Reputation of the industry

The consulting engineering industry prides itself on its professionalism and high standard of work. In order for the industry to maintain, and indeed, enhance it's reputation, a focus on quality and Quality Management will be necessary. Quality provides a competitive edge, and an enhanced reputation strengthens the perception of the consulting engineering industry.

Financial benefits

For a private enterprise, the primary motivation of effort is profit. A Quality Management System leads to greater profit from reduced operating costs, the preservation of the existing revenue and increased revenues. The pay-back time to develop and implement the system is relatively short.

A Quality Management System provides an excellent foundation for improved productivity, which can in turn reduce operating costs. Since quality assurance is about finding errors, and ensuring that they do not reoccur, eliminating the sources of errors can reduce or entirely eliminate rework and post-project support costs. Minimizing or eliminating management time spent 'putting out fires' can reduce costs substantially.

In the past, consulting firms relied on their portfolio of completed projects to illustrate the level of quality they were capable of producing. In order to efficiently compete on the world market, it has become necessary to prove you can deliver quality services constantly. By developing a Quality Management System, a firm clearly demonstrates its commitment to quality services and continuous improvement. Furthermore, taking a proactive approach to meeting clients' needs helps the firm to ensure the preservation of existing revenue.

Producing a consistent level of quality, is a major contributor to a firm's reputation. Having a formal Quality Management System sends a strong message to potential clients that the firm is serious about quality. As mentioned previously, many clients require that a Quality Management System be in place as a prerequisite to hiring consulting engineers. Thus, a Quality Management System will allow the firm to increase revenues by accessing that segment of the market.

Improved risk management

Unclear expectations, unreasonable contractual obligations, poor project management, and similar shortcomings can adversely affect a firm's liability for services and products. A Quality Management System will reduce the risk and potential costs for claims. Typical issues covering risk management in a Quality Management System can be found in FIDIC's *Risk Management Manual*.

Other benefits

A Quality Management System includes documenting the concepts, methods and techniques used in the firm, as well as improved communication and improved efficiency.

Good documentation includes establishing roles and responsibilities. This is very important since a poor understanding of responsibilities often results in items not being accomplished efficiently.

Another benefit of good documentation is the identification of features that may impact quality, a feature that helps establish consistency in the methods and techniques used. This ensures that quality will be maintained.

A well documented Quality Management System also helps to integrate new employees, suppliers, subconsultants and subcontractors without loss of quality.

Documentation provides a good foundation for improvement. Documenting all processes influencing the quality of services provided, allows for better analyses of the firm's operations. It provides objective information for the determination of the causes of poor quality.

Quality Management helps to establish improved lines of communication among employees, and between management and employees. This in turn increases internal awareness and involvement, which is achieved by discussing and documenting the concepts, methods and techniques collectively as a group. Quality Management provides an opportunity for employees to express their thoughts on the firm's methods of operation.

Quality Management within the firm also changes the firm itself and how it does business. These consequences are a powerful and positive influence on the management style, and the empowerment of the work force that ensues. In a Quality Management mode, managers lead through coaching,

teamwork, and shared responsibility. Once the resources for quality in leadership, management, policies, procedures, training, and working environment have been provided, employees participate fully. They are motivated and empowered to do their part in satisfying clients and generating quality services, of which they can be proud.

Experience and research have shown that the Quality Management System must be implemented on a continuing basis. In other words, it is a living and ongoing process, needing a continuing support structure, whose primary effort is directed toward researching, planning, implementing and maintaining the Quality Management effort. While this may appear to be a heavy burden for smaller firms, it need not be. One of the senior partners can adopt this role on a part-time,

but continuing basis. In larger firms, there will usually be dedicated personnel in the Quality Management area. In some cases, these resources may appear under various headings such as 'Risk Management', 'Contract Management' or 'Quality Management'. The name is less important than the functions.

A survey presented at the *1999 FIDIC Annual Conference* in The Hague reported the results of a survey giving the number of Quality Management personnel as a function of firm size. Responses to the survey gave numbers that appeared high, ranging from one person part time for firms of 50 to 100 employees, to about 1 per 200 for larger firms. Some 70 percent of the respondents indicated their firms had Quality Management personnel that were not charged to clients.

Interested parties

There are many parties affected by, or contributing to, issues of quality. Due consideration should be given to interested parties other than clients and employees. These other parties generally fall into three categories: owners, business partners and the public at large. Owners might include owners of the firm or

shareholders and project investors. Business partners are the construction contractor, sub-consultants, or joint venture firms. The public generally includes government authorities at all levels, and the community and the public affected by a study or physical object resulting from the services provided by the consultant.

3 The development of a quality management system

3.1 Introduction

This section describes how a typical Quality Management System can be set up in a consulting firm. It is important to recognise that each firm is a unique entity that will have to customise a system to meet its own special needs.

A training kit simplifying the initial discussions and the evaluation of the effort needed to develop a Quality Management System is available from FIDIC in the form of a PowerPoint presentation.

However varied the influences, Quality Management will contain the eight principles outlined above in Section 2.3.

3.2 The commitment of senior management

The role of senior management in the achievement of quality cannot be over emphasised. The downward delegation of Quality Management is one of the most common causes of failure, and should be actively avoided. The role of senior management is to acquire 'profound knowledge' of Quality Management, and to personally lead the quality process in their organisation.

Senior management must approach the initiation of a Quality Management process with a view to making a long-term commitment. This is because the process can be equated to taking a major journey, beginning with the important first step, but continuing forever.

Management has a number of important responsibilities in implementing a Quality Management process in the firm. Among them are:

- Based on the vision, mission and values of the firm, to formulate a quality policy in writing, and visibly demonstrate management's commitment to it. Ensure that all employees understand Quality Management and are equally committed.
- Active involvement in the planning, implementing, reviewing and improving of the Quality Management System.
- Acquire knowledge of quality principles, and identify the person responsible for implementing Quality Management in the firm, remembering that regardless of who this may be, the CEO is ultimately responsible for quality.
- Allocate the necessary resources, including management resources.
- Put in place a structure to monitor and review the Quality Management System on a formal basis, and identify the continuing needs, successes and shortfalls.

3.3 System development and implementation

Developing and implementating a Quality Management System for a consulting engineering firm can be divided into the following steps involving several clearly defined activities:

STEP 1 Formulation of the quality policy

In order to ensure ownership and commitment, it is essential that the formulation of the firm's quality policy be done by senior management in collaboration with staff.

STEP 2 Analyse current practices

Analyse how the firm currently runs its business by identifying all of the main processes, and the main steps in each process. Special attention should be given to items that can go wrong. Also, identify areas where documentation exists - both procedures or instructions describing the activities, and records kept.

STEP 3 Identification of the requirements of a Quality Management System

The requirements of a Quality Management System depend on:

- Size and structure of the firm
- Nature of professional services
- Local and national regulations and market forces
- Expectations and requirements of all the interested parties.

The requirements should be derived from the needs of the individual firm. This will often include the following items:

- National or international standards, e.g., ISO standards
- National or international guidelines, e.g., the *FIDIC Guide to the Interpretation and Application of the ISO 9001,* or guidelines issued by FIDIC Member Associations.

In this phase, it is important to identify the processes affecting the quality of the services.

A quality checklist, which can be used by the firm to identify Quality Management requirements and to conduct audits, is found in Appendix B.

STEP 4 Evaluating current practice

The gap between current practice and the requirements of the Quality Management System should be identified.

How it is identified and corrected will depend on the management style practised in the firm. In organisations with centralised management, the required changes can be initiated more rapidly than in more decentralised organisations. However, sustainability is related more to the commitment by management than to the style of management. Resistance to change should be accepted as normal, so the way in which changes are brought about should be openly discussed.

STEP 5 Documentation

A Quality Management System must be well documented, in order to provide evidence that all processes that affect the quality of a service, have been thoroughly addressed and planned. Care should be taken to avoid over-documentation, and in the process reduce the interest in the use of manuals.

However, the documentation should be structured in a functional and 'user friendly' way, reflecting the practice of the firm and the way the employees work, and be sufficiently flexible to cover the complete range of assignments the firm undertakes.

While it is vital that the policies, organisation, and fundamental procedures be documented. It is also highly desirable that all operational procedures be documented. Care should be taken not to create the impression that quality is achieved merely by documenting procedures.

Prevention and continuous improvement are the invariably the cornerstones of successful Quality Management. They are usually achieved by appropriate attitudes focussed on policies and values, in combination with an organisation which is adequately resourced, led, and managed.

It is recommended that a Quality Management System be documented in a Quality Manual supplemented by Project Quality Plans prepared for client assignments on a project-by-project basis.

Quality Manual

The Quality Manual may be divided into two documents:

- A policy document containing such topics as quality policy, extent of application, organisation charts, organizational responsibilities and authorities, and a reference to, or a summary of, the firm's standard procedures.
- A document containing the standard procedures and instructions documenting how the identified requirements are fulfilled within the firm (an example is given in Appendix A).

The Quality Manual should be a generic statement of how all projects are tackled. Only system-specific responsibilities should be assigned to named persons. Project responsibilities and authority should be assigned to generic positions identified on the organisation chart. However, for many assignments instructions are customised for each project.

A procedure should not be more extensive and detailed than need requires. The extent and detail of a procedure should reflect:

- the competence of the persons expected to use the procedure
- the complexity of the activity
- the need for consistency of the result.

A procedure should contribute to the planning, management and control of the activities to be performed. It should highlight critical activities and issues, which may need particular care and control.

The Quality Manual should be upgraded as the firm seeks to rectify non-conformities, and discovers new and better procedures. Thus, it is a living document, accessible to all staff so they are always aware of the policies and procedures that affect the quality of their work.

Project Quality Plan

A Project Quality Plan identifies the 'what, why, who, when, where, and how,' for a specific project. The Project Quality Plan should contain the specific Quality Management activities, or sequences of activities, and the assignment of resources which apply to a particular project, and should define which standard or project specific procedures apply. The Project Quality Plan should be prepared in outline at the pre-award phase, and fleshed-out on award. It should be a living document that can be updated during the course of the project.

For routine projects or services, a standard Project Quality Plan may be the answer. For non-routine projects or work in new technical or professional service areas, it may be necessary to enhance the standard Project Quality Plan to accommodate new procedures. Project Quality Plans can be as brief as a checklist or flowchart, which may include

references to existing documents. On small projects, all these items may be covered on a single page. For complex projects, quite detailed plans may be appropriate.

In setting up a Project Quality Plan the following items need to be considered:

- The scope of services provided to the client
- The schedule for completion of the assignment, and a list of the project deliverables/documents
- The division of work and the work interfaces
- The identification of services to be performed outside the firm
- Allocation of staff, responsibilities and authority for each phase of the project
- Communications, procedures and client/staff liaison
- The identification and clarification of standards of acceptability for the services to be performed, including those which also contain a subjective element
- Specific procedures, methods and task instructions to be applied to the work
- Document and data control procedures
- A methods to change and modify the Project Quality Plan as the work proceeds
- The identification of verification and approval requirements at appropriate stages in the service process
- Verification of the services to be performed outside the firm
- The identification of quality records,

and all other measures necessary to meet the objectives of the specific project and the requirements of the Quality Manual.

A Project Quality Plan will usually be developed as part of an existing Quality Management System. However, in the absence of a Quality Management System, there is no reason why a Project Quality Plan cannot be prepared on an ad hoc basis. In fact, this could be a good strategy for introducing Quality Management into a firm.

A Project Quality Plan will state the names of the personnel assigned to the project, and their responsibilities, and include evidence of their qualifications for performing their assigned tasks.

The Project Quality Plan will also nominate the quality objectives for the project and the actual resources to be used, time and cost requirements for the project, and reference or include the specific procedures applied for the project.

STEP 6 Employee commitment

Introducing a Quality Management System may meet some resistance or confusion among employees. Creating a positive atmosphere can be accomplished by appropriate measures, including:

- The involvement of various employees in preparing the procedures
- A step-by-step implementation (e.g., project/division/ geographical)
- Awareness and training
- Identification of client and staff perception of quality in their role as customers
- Provision of information of personal involvement by top management
- The carrying out of client perception studies covering expectations and service levels

- Meetings on the subject of Quality Management to increase acceptance by all
- The use of videos or similar techniques to heighten awareness.

One of the means could be to use the PowerPoint presentation available from FIDIC that introduces the basic principles and benefits of a Quality Management System.

The presentation would be presented by committed senior executives to key staff, and to as many of the support staff as considered necessary for the 'buy-in'. The aim would be to achieve a general understanding and widespread support for the system, in order for it to be used in a continuous manner.

3.4 Sustaining the quality management process

Typical activities for initiating a continuous improvement process are presented below in a 'Plan - Do - Check - Act' cycle format. The discussion assumes that management has initiated the process in line with the guidelines laid down in Section 3.3. All activities would not be required in all firms. It is important to note that although the method of implementation must respect firm size and geographic spread, the improvement process is independent of firm size.

The activities are presented in lists. Some will occur simultaneously with others, and the order could change within each group. Most of the steps will be required in every firm. It should be recalled that a sustained process will take some time to establish, and tangible signs of progress may be slow in coming. The principles of continuous improvement and the 'Plan - Do - Check - Act' mean that the process will never be complete.

Firms are encouraged to start with a single issue, and then expand. Depending upon the initial issue selected, tangible results will probably be identified early on. It will take some time, however, before processes become absolutely routine, and all employees continuously examine their work to identify ways of achieving their client's expectations with a more effective use of resources and time. The payoff occurs when Quality Management becomes an integral part of everyone's daily work, and the satisfied client feedback indicates that the firm delivers quality work and fully meets client expectations, if not exceeding them, on every project. Every client should be delighted, becoming a source of repeat business.

STEP 1 PLAN Identify the need for improvement

The need or opportunity for improvement can be identified by any of the internal or external stakeholders or other interested parties. This could include a client request, a new idea or improvement initiative from the staff, a complaint, a non-compliance issue or a new technology issue.

Actions

- Identify an individual who will be the focus for implementation, and delegate appropriate authority and resources
- Provide training for this person in the quality improvement process through seminars, readings, videos, etc., or external consultant advice
- Set up a Quality Improvement Team
- Identify methods to sustain an ongoing interest in Quality Management and to create quality awareness in all staff on a continuing basis. This could include a presentation package on Quality Management for use in management and staff meetings
- Increase quality awareness and 'buy-in' by management and all employees by having regular, short meetings on the subject of Quality Management and use videos or other techniques to heighten awareness
- Assess staff perceptions and identify attitude 'gaps' towards Quality Management and the continuous improvement process.

STEP 2 DO Initiate the improvement process

The purpose of this step is to carry out the change or the test, preferably on a small scale.

Actions

- Quality Improvement Team initiates the improvement process by describing a number of issues and improvement areas, as identified by an audit of the existing system against the identified requirements, the client and staff survey, or a review of project histories
- One important pilot issue is selected on which to focus, and agreement on this issue is obtained from senior management
- Chart current workflow of the issue
- Identify the parts of the process that need improvement
- Develop strategies to improve the process
- Refine strategies by consulting with appropriate staff
- Devise methods to measure improvement
- Initiate the measurement process
- Implement pilot improvement strategies
- Co-ordinate and communicate with required staff and others.

The experience gained from this step will be invaluable, since the continuous improvement process is cyclical, and similar approaches can be made in other problem areas, either in sequence, or in parallel, if more than one issue is being studied by multiple teams.

The issues can be very diverse, as there may be many different barriers to improve quality in firms. Remember that the Quality Management way of thinking and doing has to be adopted by all staff. Some issues can be very simple, but can have a major impact.

There is a host of areas for improvement. The problem will be to prioritise the key ones, and initiate action. As the process continues, and as all staff become comfortable with the process, recognising that they can contribute to the economic and business success of the firm, the never-ending search for improvement will be truly underway

STEP 3 CHECK Measure the results

Check the results to see what was accomplished or learned. Observe or monitor the effects of the change. The monitoring methods will vary depending on the issue under study, and could include a periodic review of all correspondence, a review of reports, or a check on time for invoices to be sent.

Actions

- Conduct ongoing measurement of the results of strategies implemented
- Monitor and coordinate progress
- Request and seek out feedback from both clients and staff
- Further refine strategies and measurement methods
- Communicate progress
- Assess improvements and the effect on company procedures
- Monitor employee attitudes towards motivation and quality processes.

STEP 4 ACT Develop and expand successful improvement strategies

The purpose of this step is to put changes into general practice, or to abandon them if the results are not useful. Document the process and improvement, and communicate it to all. As improvements start to materialise, the Quality Manual and standard procedures and instructions within the firm must be revised to reflect the new way of doing things.

Actions

- Customise improvement strategies for use company-wide, and at the same time develop appropriate documentation
- Implement improvement strategies company-wide
- Monitor and measure improvements throughout the company
- Continue to refine, coordinate and communicate results
- Generate the tools and structure of the ongoing improvement process which can be used for follow-up
- Monitor the awareness of all staff to the ongoing improvement process.
- Standardise the process improvement, and begin the process of continuously updating the Quality Manual.

STEP 5 Ongoing activities

The ongoing process of continuous improvement involves all employees of the firm. The firm and its all employees must develop the will and the commitment to carry on with the search for quality improvements in their unending pursuit of customer satisfaction.

Actions

- Continue to work on improving key business issues throughout the company
- Continue to obtain feedback from clients by involving all staff in a 'listening' strategy
- Continue to motivate, and train staff in the process
- Continue to update and disseminate quality improvement documentation
- Continue periodic audits of processes
- Continue to set increasingly higher standards and push to achieve them.

These actions restart the cycle, and are intended to convey the fact that the Quality Management process is just that a process which continues and becomes an integral part of the way work is done in the firm. It affects everyone's work every day. All staff members are encouraged to follow the example set by senior management, and to develop an attitude based on 'continuous improvement' attitude.

Rewards in the form of more repeat work, more rewarding work, more challenging work, personal and job satisfaction, client satisfaction, and a personal feeling of having contributed to these successes, can be expected. Along with this comes the enhancement of the image of the consulting engineering industry, and recognition of the vital role the industry plays in the economy and society.

Example of standard procedures in a consulting firm

PROJECT MANAGEMENT	Tenders and contracts review
	Project quality plans
	Starting and planning projects
	Administration of projects
	Purchasing
	Closing of projects

RESOURCE MANAGEMENT — Education and training

DEVELOPMENT — Software code development

SERVICES	Studies, evaluations and planning
	Design
	Main contractor document review
	Main contractor works follow-up
	Inspection and testing

DOCUMENT & DATA CONTROL	Identification and distribution of controlled documents
	Identification, protection, handling and delivery of data that is controlled and filed electronically
	Check and approval of controlled documents
	Filing and storage system

MEASUREMENT, ANALYSIS & IMPROVEMENT	Management review
	Internal audits
	Non-conformances
	Corrective and preventive actions
	Control of measuring, inspection and test equipment
	Experience and feedback

Appendix B
Quality management checklist

The following checklist is adapted from an ISO 9001 checklist for internal quality audits initially prepared by Sanders Quality Associates, Inc. and published by the American Management Association.

The checklist has been adapted for the use of architectural and engineering firms by R. Marbury, III, and further adapted and simplified for use in this Guide.

Formatting and some content have also been inspired by the American Consulting Engineers Council Peer Review guides.

The checklist is presented here to describe and detail the many different facets of an engineering organisation that may feature in a firm's Quality Management activities.

The checklist is organised in six separate sections:

- Quality Management System
- Management Responsibility
- Resource Management
- Financial Management
- Product/Service Realisation
- Measurement, Analysis & Continuous Improvement.

Different firms may want to initially focus their efforts in different areas, appropriate to the complexity of their firm, their method of operation and other local factors. Eventually the Quality Management culture will require the programme to expand to all aspects of the firm's operations.

This checklist can be used by the Chief Executive Officer to conduct a preliminary audit of the firm's practices, in order to determine if the introduction of formal Quality Management needs to be considered, and if so, perhaps to indicate the areas on which to concentrate during the initial phases.

Quality Management System

1 How do the firm's vision, mission statement and policies address quality?

2 Are these values and principles reinforced and updated?

3 Is there a current Quality Manual explaining who does what, when, and where?

4 Does the Quality Manual include standard operating procedures for controlling and assuring quality in:

    Customer relationships
    Staff relationships
    Assessments and studies
    Design

    Procurement
    Shop drawing review
    Construction observation and review
    Internal quality audits
    Document and data control
    Customer satisfaction

5 Does a quality plan exist for each area of organisational activity or for each assignment?

6 Have the quality control, quality assurance, continuous process improvement, and training programmes, required to achieve the desired quality, been identified, and are they in place?

7 Is there a method to identify needed improvements?

Management responsibility

1 Is the Chief Executive Officer committed to ensuring that quality standards are identified?

2 Do senior executives provide effective leadership and direction in implementing and maintaining the firm's quality standards?

Quality policy

3 Is there a written mission statement on quality?

4 Is the quality policy clearly defined, implemented and maintained?

5   Are all employees aware of the quality policy?

6   Are quality objectives established for each employee assignment?

Organisational responsibility and authority

7   Is the responsibility, authority and interrelationships of all who manage, perform and verify work clearly defined?

8   Is there a person or team with responsibility to identify and to take actions on quality problems?

9   Is there a person or team with authority to develop improvement systems?

10 Is there a clearly defined way to verify the implementation and results of the proposed systems for improvement?

11 Is there a person or team with the authority to standardise successful improvement systems?

Verification resources and personnel

12 Are verification requirements identified?

13 Do personnel have adequate training and resources to verify activities?

14 Do verification activities include:

- Review at designated benchmarks?
- Checking of the output?
- Review of the adequacy of the constructed product?
- Audits of the quality system processes & products?

Quality management staff

15 Has a quality leader been appointed to be responsible for the quality management system?

16 Does the quality leader report directly to senior management or serve as part of the senior management team?

Control of documents

17 Are there documented procedures for controlling all documents and data required for the quality management system, including output documents?

18 Are all documents, required for the quality management system, reviewed and approved by authorised personnel prior to issue?

19 Are current copies of appropriate documents available at all locations where operations require their use?

20 Have personnel, reviewing and approving document changes, access to pertinent data upon which to base their decisions?

21 Where sets of preliminary or status documents are submitted, do these documents have a unique identification?

22 Is there a master control list that identifies the current version of documents?

Quality records

23 Are there documented procedures for the identification, collection, indexing, filing, storage, maintenance, and disposition of quality records?

24 Are quality records being generated and maintained?

25 Do these records demonstrate achievement of the required quality and the effective operation of the quality system?

26 Are quality records easily accessible?

27 Have retention times of quality records been defined and recorded and agreed to by client?

28 Where necessary, are quality records available for evaluation by customers?

Management review

29 Is the quality management system periodically reviewed to ensure its suitability, adequacy and effectiveness?

30 Do these reviews include analysis of results of internal quality audits?

31 Does management act on these reviews?

32 Are records of these reviews kept and maintained?

Quality management checklist

Resource management

Employees

1 Is information on an individual's skills and experience recorded, maintained and updated?

2 How is this information communicated?

3 Do employees, whose activities affect quality, have appropriate education, training, and experience for the assigned tasks?

4 How are continuing education, conferences, workshops, seminars, professional societies, on-the-job training and self-study encouraged to develop an employee's skills and knowledge in needed areas?

5 Are appropriate training records kept & maintained?

6 Does compensation and recognition for groups and individuals reinforce work effectiveness and quality assurance?

7 Does each employee know and understand what is expected in his/her job?

IT equipment

8 Is purchased computer software verified prior to use?

9 Are computers and software compatible and standardised?

10 Is it assured that computer files are regularly updated and backed-up?

11 Are bugs in software and 'workarounds' properly handled?

Financial management

1 How does the firm manage its finances and assure adequate cash flow?

2 Does the firm have project specific accounting information?

3 Does the firm share accounting information with its department and project managers?

4 Is accurate accounting information in the form of P/L (profit and loss) statements made available within days of closing a (monthly) accounting cycle?

5 Does the firm submit its accounts and operations to an independent outside financial audit at least once a year?

Product/service realisation

1 Have the service providing processes, which directly affect quality, been identified?

2 Have the primary process characteristics, which affect quality, been identified?

3 Are there documented procedures for each of these processes, and do they address these primary process characteristics?

4 Are the procedures up to date and in use?

5 Do the procedures ensure qualified personnel to perform the activities constituting a process?

6 Do the procedures ensure that personnel have adequate resources and equipment to adequately perform their jobs?

7 Where applicable, are there formal documented criteria for output requirements and processes?

8 Are standard check sheets or checklists used to ensure conformance to requirements?

Proposals/contract review

9 Are there criteria for determining what constitutes a contract?

10 Is a proposal/contract reviewed both technically and legally?

11 Is proposal/contract review a co-ordinated activity?

12 Are proposals/contracts reviewed for adequately defined and documented requirements?

13 Are differences between the initial proposal and the proposed contract resolved?

14 Are proposals/contracts reviewed to ensure that the capability to meet contractual requirements exists?

15 Are records of such contract reviews maintained?

Planning

16 Are the necessary activities for performing the services identified?

17 Is responsibility for each activity identified?

18 Is this responsibility updated as the work evolves?

19 Are verification activities integrated into the planning?

Organisational and technical interfaces

20 Are organisational and technical interfaces between different groups identified and co-ordinated?

21 Is the necessary project update information documented, transmitted, and regularly reviewed?

22 Are effective lines of communication established between different internal groups and with external parties?

23 Are there regular, documented project meetings?

Input

24 Are input requirements identified and documented?

25 Are these input requirements reviewed for adequacy?

26 Are unclear or conflicting requirements resolved?

27 Are the conflict resolutions co-ordinated with those responsible for establishing the requirements?

Output

28 Is output documented in terms of requirements, calculations, and analyses?

29 Is output reviewed for conformance with input requirements?

30 Does the output contain or reference acceptance criteria?

31 Is the output reviewed for conformance to regulatory requirements regardless of whether these are specified in the input information?

32 Are characteristics crucial to the safe and proper functioning of the financial product identified?

Verification

33 Is it verified that the output conforms to input requirements?

34 Do verification include documented reviews, checking, qualification tests or demonstrations, alternative calculations, or comparisons of the new design with a similar proven design already available?

35 Are controls in effect assuring applicable drawings, change notices, and specifications are in use during production and construction review?

Changes

36 Are all changes or modifications of the services provided reviewed and approved?

37 Is there documentation that changes, or modifications that are made known to all parties affected?

Purchasing

38 Are subcontractors and suppliers evaluated and selected on the basis of their ability to meet contract requirements, including quality?

39 Is the result of this evaluation of subcontractors and suppliers documented?

40 Is risk assessment and the availability of professional liability insurance part of the selection criteria for purchasing?

Quality management checklist

Measurement, analysis and continuous improvement

Client satisfaction

1 Is there an effective and ongoing system of measurement of client satisfaction?

2 Are adequate client satisfaction records maintained by the firm?

3 Have follow-up procedures been developed and effectively implemented?

Internal quality audits

4 Has a documented, comprehensive system been developed for conducting internal quality audits?

5 Is the internal quality audit system capable of verifying the efficiency and the effectiveness of the quality management system?

6 Are audits scheduled on the basis of importance and tests of the activity?

7 Are audit procedures and follow-up actions defined and documented?

8 Are audit results brought to the attention of the personnel having responsibility in the area audited?

9 Are audit results documented?

10 Are audit results brought to the attention of the appropriate management so that corrective action may be taken?

11 Is corrective action taken on the deficiencies found in the audits?

Corrective action/control of non-conformances

12 Are there documented procedures for corrective and preventive action?

13 Are non-conformances investigated to search for trends, as to their common or root cause?

14 Are action items implemented and evaluated?

Continuous improvement/Kaizen

15 To what degree are employees empowered to seek improvement, and how is that empowerment communicated and monitored for appropriateness?

16 Can it be proven that the service quality and the effectiveness/efficiency of the complete operation is continuously improved?

Evaluation of Quality Management Systems

1 First-party evaluation

First-party evaluation is a Quality Management System that includes an effective continuous improvement component being self-verified by the employees and the management.

The frequency of changes to the Quality Management System documentation resulting from improvement initiatives invariably tells a significant story.

2 Second-party evaluation

Since client satisfaction is the primary objective of Quality Management, the clients themselves are the best source of Quality Management verification.

Effective client satisfaction feedback provides the best evidence of how successfully the Quality Management System is operating.

3 Third-party evaluation

1 Introduction

The issue of third party evaluation of a firm's Quality Management System has become a topic of concern among Consulting Engineers across the world. The third party evaluation can be viewed from two different perspectives:

- From the firm's point of view, to have somebody from outside to review the Quality Management System in order to identify possible areas for improvement of the efficiency and to improve the quality of the firm's services to the client.
- From the client's point of view, to have impartial evidence that the firm they select, or allow to propose for their work, has a Quality Management System. This could be because the client has a Quality Management System in place and wants to ensure that all the participants in a project are so qualified, or it could be a means some clients may wish to use to prepare a list of eligible firms.

Two different types of third-party evaluation are detailed in the subsequent sections:

- Peer Review
- ISO Certification.

Much of the attractiveness of Quality Management as described in this Guide, lies in the development of a Quality Management 'culture' within the firm, and the infiltration of this Quality Management 'culture' into the everyday working lives of all employees, to the extent that all staff, from top management to the newest employee, continuously seek to improve service to clients, internal and external. This 'attitude' towards work cannot be certified by outside auditors.

2 Peer review concept

Introduction

The United States and a few other countries offer design firms a very effective quality tool called Organisational Peer Review, often shortened to Peer Review. In summary, a team of very experienced managers and owners of design firms reviews a firm's practices and procedures involving design management issues. This is a three-step process involving the review of documents, an on-site visit and interviews, and a verbal report followed by discussion with the firm's leadership.

The fundamental purpose of Peer Review is to improve the quality of the firm's services to clients. Peer Review has a core philosophy that all of a company's endeavours can affect quality. For example, if a firm's finances are not well managed, the leadership focuses on payroll, overhead, invoices and cash flow, all to the detriment of service quality to clients. Similarly, a company may create unrealistic expectations in its marketing effort. Employees, unhappy owing to a poor human resources management effort, may not care about quality.

Evaluation of Quality Management Systems

Here are the categories in the scope of Peer Review:

- General management and organisation
- Business development
- Human resources management
- Financial management
- Information technology
- Professional development
- Project management.

Peer Review imposes no external standards on a firm. Instead, it first determines internal standards, practices and procedures, as perceived by the firm's senior management. The review team then sets to reconciling this management view of the way the firm does business with what is actually happening in offices, drafting rooms and reception areas, and in the field.

Formal procedures and manuals are not required for a review. Indeed, firms are discouraged from creating new policies and documents for the review, as they will be too new to evaluate. Peer Review believes informal, unwritten policies and procedures can be very effective.

Typically, some of the Peer Review team's findings are a surprise to management, others are not. In the final confidential conference with the firm's leadership, the review team explains the discrepancies between stated and actual practice. Reviewers also give their views on areas where no policy exists. The team confines its remarks to what it has observed, and what it believes to be the potential consequences thereof. Reviewers to not develop solutions in this meeting, that is for the firm's management and staff. However, after the review, review team members often share ideas and documents with the firm for months, and even years.

3 ISO Certification

Many clients and countries are committed to ISO certification. This is an attractive course for some aspects of Consulting Engineering as it represents an international standard, applied consistently and verifiable by an accredited third party.

If you are considering certification/registration process, your first step imust be to hold discussions with

Peer review and quality management

Peer Review supports and enhances a Quality Management System in several ways:

1 Measurement

Peer Review is very helpful in measurement satege, a difficult part of the Quality Management process for design firms. A peer review gives the firm's owners and managers an excellent benchmark from which to measure future progress. For this reason, many firms begin a Quality Management process with a Peer Review. The report of the reviewers is verbal, and statistics are only a part of it. The process nevertheless provides management with a detailed view of the firm's status on key matters affecting quality.

2 Total review

Quality Management means that everyone and every area of the company are committed to making improvements. Peer Review looks at all of the key areas (see scope above), from the firm's overall organisation to project management. In small firms, reviewers talk to everyone; in larger companies, reviewers sample the staff, talking to people from all levels.

Peer review and small firms

Owners of some smaller companies have said that Peer Review is for larger firms, that they do not have the formalised procedures, and that they cannot afford a Peer Review. Quite the opposite is true. In smaller firms, Peer Review, like Quality Management, is probably superior because everyone in the firm is interviewed and participates. Smaller firms can often act on the reviewers' findings much more rapidly and more effectively.

an experienced consultant in quality management to find out what services are being offered, what the likely costs are, the period for which the certification/registration will apply, and how frequently your Quality Management System will need to be reviewed. Some consultants may include an initial pre-assessment in their offer. This can be of major benefit in finding out what needs to be done.

Before the actual certification/registration, it is essential to have the system in place and running for a few months. This will also save you time and money. Recognised consultants do not operate on the principle of 'what is going to happen'. They want to see what has happened. A few months of records demonstrating the operation of your Quality Management System will be worth more than all the promises.

The other benefit is that you can see the system in operation and have the opportunity to fine tune the system.

Any problems that you find which can be rectified at this stage will simplify the certification/registration process.

There are three classes of certification/registration. First, you may make a 'self declaration' of conformity. Second, is an audit carried out by your customer(s)? Third, is an independent body involved?

The outline below is based on that typically adopted by independent third parties.

1   You make formal application to the certification/registration body. The application normally includes a description of your business activities, the services range, and any other information requested. The certification/registration body may ask for a questionnaire to be completed.

2   Next, the certification/registration body will review your Quality Manual. What it will be looking for is how well the Quality Manual describes what you say happens against what the standard says should happen.

3   Where there are deficiencies, the certification/registration body will indicate where the problems are. Amendments to the Quality Manual will normally overcome most problems, but you may also have to develop additional procedures. A further review of any changes is carried out. It is often combined with one of the following stages.

4   The certification/registration body may then hold a pre-assessment check of go straight to the certification/registration audit.

5   In the certification/registration audit, the auditor(s) will use the Quality Manual and any procedures as a guide to how your business operates. The auditor's operative words will be 'show me'. The auditor will be looking for records, documents, or other objective evidence to verify that you are doing what your Quality Manual or quality procedures say you do.

6   Where inconsistencies (nonconformities) are found, the auditor's actions depend on how serious these are. For major nonconformities, the certification/registration could be withheld pending correction. For minor nonconformities, a qualified certification/registration might be issued, pending correction by the next compliance audit.

7   Once certification/registration is granted, the certification/registration body will carry out compliance audits of the system over the period for which the certification/registration is valid. These audits are not as comprehensive, in that the full system is not necessarily assessed at each compliance audit.

8   If nonconformities are found during a compliance audit and not corrected within a specific time, certification/registration may be withdrawn. Minor nonconformities may be required to be corrected by the next compliance audit.

Appendix D
Misconceptions about Quality Management

All of the matters mentioned in this Guide have significance for firms that seek to justify the adoption of a quality outlook. Nonetheless, Quality Management continues to suffer from a number of myths that preclude many organisations from exploring and fully implementing its principles. Each deserves discussion.

Quality is costly

Some detractors of the quality movement argue that the implementation of a Quality Management System is expensive, whereas the reverse is true. Crosby, and others have demonstrated that the absence of Quality Management is extremely expensive and threatening to an organisation. Crosby stated that 'quality is free', and that without quality, organisations do not prevent problems. Instead, they pay for their detection, and the cost of client and staff generated rework, and lost repeat business. Even in cases where rework may not be required, a firm will typically expend excessive labour and direct costs on projects in confirming the absence of non-conformances. These resources are better directed at other projects for the client.

Too much paper work

Quality Management is another set of management requirements piled on top of the organisation's existing management structure. Quality Management is the method or process by which the firm manages its operations correctly to begin with. It guides a firm while it is establishing its processes, and influences its leadership and workforce so as to ensure they carry out the processes correctly the first time, thereby reducing, rather than creating, additional paperwork.

Too long a process

Quality Management, it is argued, adds unnecessarily to the length of time it takes for the firm to do its work. However, the real test of a process and its proper length comes into focus when the amount of time spent on rework, and 'mending fences' in their aftermath, is considered. Furthermore, without an accurate measure or baseline from which management and project tasks can be assessed or improved, there will never be a clear sense of what actually is the proper time to complete the process or task.

Simply unnecessary

Some managers claim that Quality Management is unnecessary. They assert that the principles of Quality Management are simply common sense, and that they already apply some of them, as needed, to the management of their firm. Others suggest that their management style does not require Quality Management. It is true that many tenets of Quality Management are common sense, but without constant and rigorous commitment and application, the potential benefits will not be realised. Some management styles neither sense the importance of nor incorporate Quality Management because the management does not value the importance of the process, or cannot trace the effects to the causes. These perspectives do not recognise that Quality Management is not an added extra, but is, in and of itself, a way to manage the firm and to provide objective information.

These misconceptions about Quality Management are significant enough to preclude many firms from undertaking a programme. Firms that successfully implement Quality Management note that Quality Management: limits expenses and generates revenues; focuses the generation of data and its management in prudent ways; and creates a realistic understanding of what it takes to do a job, and how to improve on it. Quality management is a necessary, integral element of how the firm does business, leading simultaneously to improved customer service and the bottom line.

Appendix E
Further reading

1. Roger D. Hart
   Quality Handbook for the Architectural, Engineering, and Construction Community
   American Society for Quality, 1994

2. *Quality in the Constructed Project*
   American Society of Civil Engineers, 1988

3. *Quality Assurance for Consulting Engineers*
   American Consulting Engineers Council, 1986

4. Philip B. Crosby
   Quality is Free
   McGraw-Hill Book Company, New York, 1979

5. Philip B. Crosby
   Quality Without Tears
   McGraw-Hill Book Company, New York, 1984

6. J.M. Juran
   Quality Control Handbook
   McGraw-Hill Book Company, New York, 1979

7. H. James Harrington
   The Improvement Process.
   How America's Leading Companies Improve Quality
   McGraw-Hill Book Company, New York, 1987

8. T.W. Hardjono et al.
   The European Way to Excellence.
   How 35 European manufacturing, public and service organisations make use of quality management
   Directorate-General III Industry, European Commission

9. Clive Shearer
   Practical Continuous Improvement for Professional Services
   ASQC Quality Press, Milwaukee, Wisconsin, 1994

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