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Acknowledgements

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The Standards Associates have since become the British Standards Society and there have been a number of catalysts and milestones to the progress of standardization both nationally and in-company, with metrication, decimalization, the massive interest in quality control and legislation concerning product liability, health and safety at work, consumer protection and control of substances hazardous to health (COSHH) precipitated by our closer ties with Europe.

A major revision of PD 3542 was undertaken in 1980, incorporating contributions from Dr J T Grayson, who was then Professor of East European Studies at Birmingham University, Richard Wright and David Lunn, who worked tirelessly for and on behalf of the north west region, Tom Chapman from the north east, my own employers, GEC Alsthom Protection & Control Ltd. (then GEC Measurements), and the BSS Management Committee of that time under the chairmanship of General 'Jim' Gavin.

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Trevor Ashton
Editor
Midland region, British Standards Society
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Section 1. Introduction

This publication is intended as a guide to the organization and application of standardization. It has been compiled from the experience of company standards engineers as a management reference and as a training aid for anyone allocated specific responsibility for preparing standards in their organization or more generally in quality management.

Thirty years of technological development and experience of standardization needs have confirmed and consolidated the basic principles described in the first (1959) edition and re-emphasized the need for a comprehensive and up-to-date guide to company standardization practice. The experienced members of the British Standards Society, including that coming from the work of the International Federation for the Application of Standards (IFAN), has been incorporated in subsequent editions.

Standardization is now recognized as a vital ingredient of industrial efficiency and a prerequisite of quality management systems. In revising this publication the emphasis has been shifted from a justification for the standards produced by the dedicated professional standardizers, to more positive guidance to the many industrialists, quality managers or trading standards officers more recently involved with their application. It recognizes the need for background knowledge about standards and certification facilities. For this reason, the organization of standardization in the context of the law and, particularly, of European Community developments, is first explained with the help of information extracted from notes provided by BSI. Later sections cover the contribution to be made by company standards and aim to help with the introduction of standardization, providing a basis for comparison with readers' own theories and experiences.

The revision takes account of new developments and techniques. The opportunity has been taken to highlight the use of information technology, the relevance of recent drives for improved quality on a national and European scale, and legislation concerned with health, safety and product liability. It is written in terms of company standards and the standards 'practitioner'. The term 'standards engineer' is used throughout to describe all people employed in the task, regardless of their particular title, but emphasis on the employment of a single person engaged entirely on standardization has been removed. Standardization techniques may be interpreted and applied in any manufacturing or service industry, for example with regard to product liability, stock control, quality control, purchase specification or meeting statutory regulations. The functions described in this publication cover many areas likely to be encountered in typical manufacturing, distribution, consumer or service organizations. Standards management is important to them all.

The work of many standards and quality organizations facilitates communications, industrial competitiveness and technological legislation. Agreements reached globally or at European level permeate through national bodies such as the British Standards Institution (BSI) into the grass roots of companies and are applied as company standard specifications and codes of practice. Successful standardization techniques will vary according to the needs of the country, the company, the practitioner and his area of influence or authority, and those described herein have proved to be well capable of the sort of flexibility demanded.

Section 2. Standardization, the law and the European Community

2.1 Standardization: aims and principles

The extent to which standardization techniques can be of value to an organization is illustrated by the aims promoted by the International Organization for Standardization (ISO):

- overall economy in terms of human effort, materials, power, etc. in the production and exchange of goods;
- the protection of consumer interest through adequate and consistent quality of goods and services;
- safety, health and protection of life;
- the provision of a means of expression and of communication between all interested parties.

(See figure 2.1.)

2.2 Definition of a standard

A standard is defined as a document, established by consensus and approved by a recognized body, that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context.

The content of a standard is determined by its scope, and that is agreed collectively by the representative interests involved. What they want may be an agreed terminology or classification, or methods of measurement or testing, or they require verifiable criteria for a standard product or some practical recommendations or guidance for its use. The possibilities are almost limitless. Standards should be drafted in objective terms; the compliance criteria should relate to verifiable attributes of a product or service, which will then conform because it is what it is, not because someone says it does.

Standards are made publicly available mainly by the national standards bodies, which collaborate in the European and global standards organizations. These bodies cannot, however, compel the use of the standards they adopt. Use of standards may be enforced by law only through their incorporation in contracts, in trade descriptions or in legislation. Such actions are outside the control of the standards bodies.

Standards should not be confused with regulations. Regulations are part of the law. For clarification of terminology in this area, attention is drawn to ISO/IEC Guide 2, 'General terms and their definitions concerning standardization and related activities'.

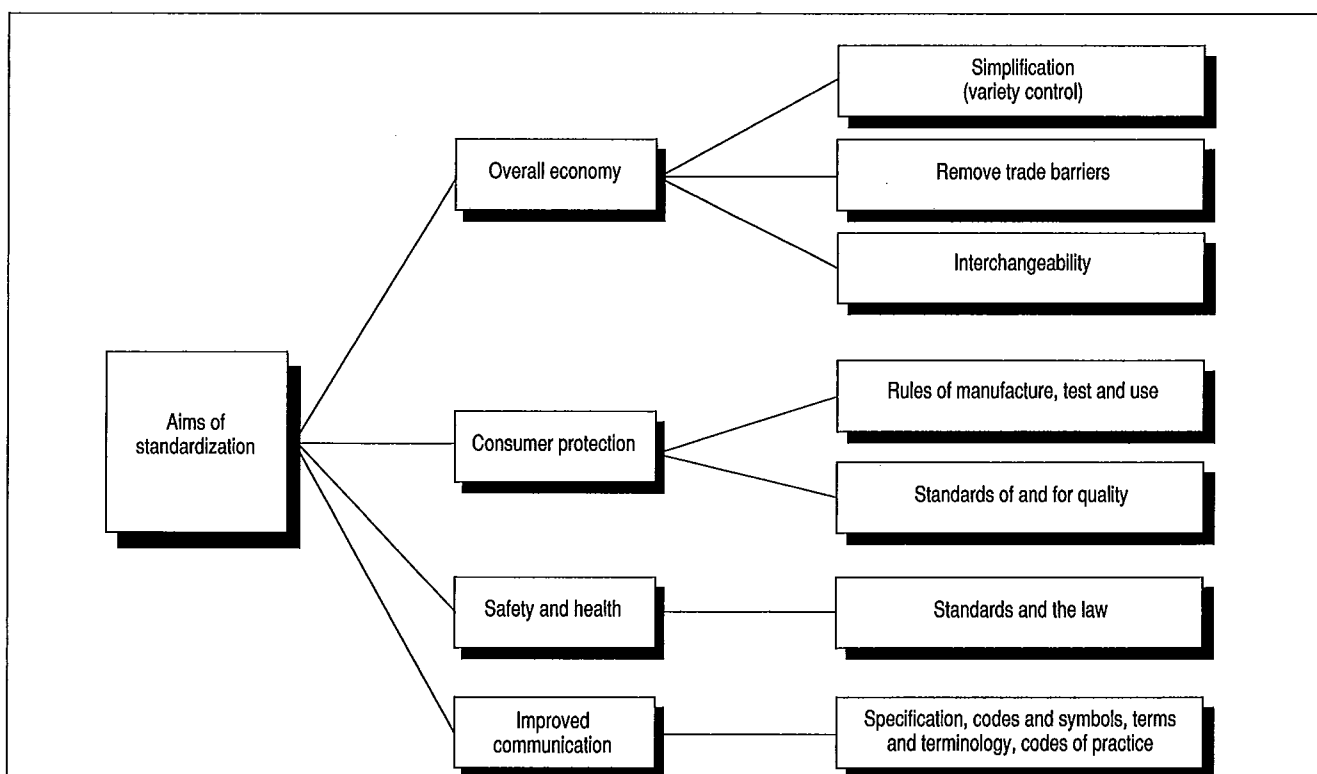


Figure 2.1 Aims and results of standardization

2.3 Standardization in the UK

The UK national standards body is BSI, the British Standards Institution, incorporated by Royal Charter since 1929 as a non-profit distributing association of members. In 1982, following the Department of Trade White Paper on standards, quality and international competitiveness (Cmmd 8621), Government signed a Memorandum of Understanding endorsing BSI as the national standards body and the UK member of international and European regional standards organizations. As an independent and impartial body, BSI serves all interests, in both the public and the private sector.

Standards work in BSI depends on income from sales of standards and from subscriptions. Additionally, in recognition of its importance to industry, to the consumer and to the country's economy as a whole, it receives a substantial government grant in aid through the Department of Trade and Industry.

As a guide for those involved in standards work, BSI provides BS 0, 'A standard for standards', explaining the principles of standardization, committee procedures and drafting rules. Members of BSI committees may obtain BS 0 at subscribers' discount prices and a study of Parts 1 and 2 particularly should enable a committee member to attend national and international meetings with confidence.

Under the overall responsibility of the standards board, standards work in BSI is organized through six standards councils or sector boards. These have a number of standards policy committees responsible to them which control the work of the technical committees. For example the engineering standards council includes standards policy committees for aircraft, automobile, general mechanical, pipe systems and pressure vessels standardization. Technical committees, numbering more than 3000, and amounting to 25 000 committee members, prepare the standards. The technical committees may set up subcommittees or small working groups to deal with distinct aspects of a standard.

The national standards body frequently takes the blame for the shortcomings of the standards it publishes. However, such criticism overlooks the fact that the content of British Standards is determined not by BSI officials but by voluntary contributions of those who are willing and able to serve on BSI committees. If a standard is considered inadequate, it is always within the power of the critic to contribute to its improvement.

It is usually not difficult to justify serving on a committee by a manufacturer concerned with the company products. Justification of the costs of user involvement in standardization poses more problems but as users of commodities such as raw materials and the 'nuts and bolts' it behoves all companies to take as active an interest as possible. This should be achieved by the company's representative paying attention to the work being done in these fields and his getting himself involved, e.g. via the British Standards Society or communicating and contributing through trade associations, professional or other representative bodies, to influence the creation and development of the relevant standards.

A range of information and consultancy services is provided by BSI to suit the needs of its members and clients. Brief details are given in appendix B. A summary of BSI publications is given in appendix A.

2.4 Standards and the law

2.4.1 Implications of the law

The Health and Safety at Work etc. Act 1974 and similar legislation are a part of the criminal law as are the many supporting Regulations and Orders.

In some cases compliance with designated British Standards is specifically required by legislation – the British Standard becomes 'mandatory' – and the failure of a product to comply with the standard would be an offence. However, in other cases products supplied or offered for supply and described or marked as complying with any standard could, if falsely described, infringe the general provisions of the Trade Descriptions Act 1968.

This wide-ranging legislation creates offences for false and misleading statements applied to all types of products and services. Civil action may also be possible by one company against another for misrepresentation or similar failure to comply with a specific description or implied quality of product.

Codes of practice are increasingly being used to complement statute law such as the Health and Safety at Work etc. Act 1974. They underpin the law and provide further guidance on implications and procedures. Failure to comply with a statutory code of practice may be cited in criminal proceedings against a company or an individual.

The European Community is providing an even wider framework of law and, given the range and scope of the new approach directives linked to completion of the single market, it is clear that standards are taking on an even greater significance as means of compliance with the law.

2.4.2 The Health and Safety at Work etc. Act 1974

The scope of the 1974 Act was 'to make further provision for securing the health, safety and welfare of persons at work, for protecting others against risks to health or safety in connection with the activities of persons at work, for controlling the keeping and use and preventing the unlawful acquisition, possession and use of dangerous substances, and for controlling certain emissions into the atmosphere; to make further provision with respect to the employment medical advisory service; to amend the law relating to building regulations'.

The Act is an enabling measure superimposed over existing health and safety legislation. The existing duties under, for example, the Factories, Offices, Shops and Railway Premises Act and the Mines and Quarries Act remain in force, the main provisions of which, for the time being, continue. This provides one comprehensive and integrated system of law to deal with health and safety at work, and the protection of the public affected by the activities of people at work.

The provisions for enforcement of the earlier Acts have been replaced by the Health and Safety at Work etc. Act 1974. This includes powers to issue improvement and prohibition notices and to prosecute. The general duties of employers to their employees are set down in Section 2 of the Act.

Section 2(1) Establishes 'the duty of every employer to ensure, so far as is reasonably practicable, the health, safety and welfare at work of all his employees'.

Section 2(2)(a) Requires the provision and maintenance of plant, which the Act defines as including machinery, equipment and appliances used at work. It does not supersede the more detailed and specific provisions covering certain equipment contained in existing legislation, but it applies to all plant used in any work activity, whether or not subject to existing safety legislation.

Section 2(2)(b) Requires 'arrangements for ensuring, so far as is reasonably practicable, safety and absence of risks to health in connection with the use, handling, storage and transport of articles and substances'.

This subsection is concerned with materials and substances whether in solid or liquid form or a gas or

vapour, so that the subsection covers everything used at work and all work activities.

Section 2(2)(c) Requires of an employer 'the provision of such information, instruction, training and supervision as is necessary to ensure, so far as is reasonably practicable, the health and safety at work of his employees'.

Section 2(2)(d) Requires 'so far as is reasonably practicable as regards any place of work under the employer's control, the maintenance of it in a condition that is safe and without risks to health and the provision and maintenance of means of access to and egress from it that are safe and without such risks'.

Section 6 Places specific duties on those who can ensure that articles and substances are as safe and without risks to health as it is reasonably practicable to make them. Articles must also be properly erected and installed. The section was amended with effect from 1 March 1988 by the Consumer Protection Act 1987. It covers:

- (a) new and second-hand articles designed for use at work, whether for sale or hire, and their component parts;
- (b) items which though capable of domestic use are designed to be used also at work;
- (c) new and second-hand items of fairground equipment;
- (d) all substances, including micro-organisms, which are supplied to workplaces or to certain other non-domestic premises.

The safety of goods originally intended for domestic use is subject to other legislation, particularly the Consumer Protection Act 1987 and Regulations relating to consumer goods.

In addition to placing duties of a general character on employers, manufacturers, employees, and the self-employed and others, the Act provides a wide regulation-making power. Part 1 provides for securing the health, safety and welfare of people at work; protecting other people against risks to health or safety arising from the activity of people at work; controlling the keeping and use of dangerous substances and preventing unlawful acquisition, possession and use; and controlling the emission into the atmosphere of noxious or offensive substances from prescribed premises.



2.4.3 Control of substances hazardous to health (COSHH)

The Control of Substances Hazardous to Health Regulations 1988 came into force on 1 October 1989. These regulations enable Directive 80/1107/EEC concerned with workers' health to be implemented and impose duties on employers to protect employees and other persons who may be exposed to substances hazardous to health and also impose certain duties on employees.

The regulations introduce a new legal framework for the control of substances hazardous to health in all types of business including factories, farms, quarries, leisure and service activities, offices and shops.

Hazardous substances include any dusts, liquids, pastes, gases, powders, oils, sprays, aerosols or micro-organisms that can cause long-term harm to workers.

The regulations do not cover asbestos, substances below ground in mines, materials producing ionizing radiations and lead, which are all regulated by separate legislation.

Employers must:

- (a) assess the risk to health arising from work and what precautions are needed;
- (b) introduce appropriate measures to prevent or control the risk;
- (c) ensure that control measures are used and that equipment is properly maintained and procedures observed;
- (d) Where necessary, monitor the exposure of the workers and carry out an appropriate form of surveillance of their health;
- (e) inform, instruct and train employees about the risks and the precautions to be taken.

2.4.4 Product liability/consumer safety

The Consumer Protection Act 1987

The Consumer Protection Act 1987 covers responsibilities to the customer, rather than the employee, and encompasses product liability (Part 1) and consumer safety (Part 2). The Act became law in March 1988.

Product liability

Responsibility is now imposed on the manufacturer/producer to prove he is not liable for damage caused by a defective product. Standard systems and procedures must be designed to identify and control components, materials and methods to ensure a safe and reliable product. Standards are not directly mentioned in Part 1 of the Act, but they can be used by either party as a means of defining the expected safety level.

Consumer safety

Part 2 of the Act makes it a criminal offence to 'supply, offer for supply, expose or possess for supply any consumer goods which fail to comply with the general safety requirement'. The general safety requirement makes specific reference to standards and safety regulations.

2.4.5 The Environmental Protection Act 1990

There is concern to improve the environment in our cities, towns and places of work as well as the surrounding countryside. Of growing concern is waste disposal with 350 000 tonnes of waste being produced in the UK every day.

Most of the Act is relevant to industry and can be briefly summarized as follows:

Part 1 (a) Integrated pollution control (IPC). This applies to some of the potentially worst polluting industries and will be administered by Her Majesty's Inspectorate of Pollution. Industries scheduled for IPC will have to employ Best Available Techniques Not Entailing Excessive Cost (BATNEEC) and the controls will apply to all discharges whether to land, air or water.

Part 1 (b) Air pollution control. This will be introduced for industries slightly less polluting than those scheduled for IPC and will cover a wide range of uses from glass works to coating processes. Again BATNEEC will apply and industries will have to apply to their local authority Environmental Health Officers for prior authorization. In the case of existing premises some will benefit from temporary relaxations in the early years but must be authorized in one of three phases between 1 April 1991 and 1 April 1993.

Part 2 Waste on land. Responsibility for waste will come under much stricter control and this will extend 'from the cradle to the grave'. This will involve carriers as well as disposal site operators and responsibility for licensed disposal facilities will continue until the waste regulation authority issues a certificate of completion. In many cases this will be several years after disposal has ceased. Fresh and far-reaching controls will also be provided in relation to gaseous and liquid emissions from closed sites.

Part 3 Statutory nuisance. These provisions are already in force and re-enact the nuisance provisions of the Public Health Acts and the noise nuisance provisions of the Control of Pollution Act.

Part 5 Amendments to the Radioactive Substances Act 1960. These remove exemptions from the UK atomic authority and crown premises and introduce enforcement and prohibition procedures.

Part 8 Miscellaneous. This part brings in wide-ranging controls over the importation and export of wastes, including powers to obtain information. It introduces the concept of public registers for potentially contaminated land and extends the controls over disposal of substances and articles at sea first introduced under the Food and Environment Protection Act 1985.

Environmental audit

Environmental audits will involve checking against existing legislative and in-house standards to ensure protection of the environment. Quality assurance techniques can be employed to ensure compliance with the standards.

It is expected that new European legislation will be implemented in 1993 which could set new, higher standards for the UK. The design stage could incorporate factors such as energy conservation, waste reduction and recycling of materials. This would mean a review of the materials used, the waste produced or the energy consumed and could mean altering processes, for example, painting or spraying to use less or no solvents.

2.5 International and European standardization

2.5.1 General

Standards are as international as the markets they serve, and BSI's outlook has always been towards world markets, helping to promote the acceptability of UK exports and imports.

2.5.2 ISO and IEC

Through its Electrotechnical Standards Council, BSI is a member of the International Electrotechnical Committee (IEC) established in 1906 to provide international standards in the electrical field.

Alongside the national standards bodies of more than 80 other countries, BSI is also a member of the International Organization for Standardization (ISO), founded in 1947.

In the past ISO and IEC have pursued separate and distinct paths with separate procedures and format of documents. Recently moves have been made to bring the operations of the two bodies more into line and for there to be closer cooperation between them. These moves have been given added impact in areas where there is an overlap of interest between the general and the electrotechnical fields. Joint committees have been set up to avoid duplication of work, and common drafting rules now apply.

Since the 1970s, BSI has published ISO and IEC standards as identical British Standards, with a national foreword and a parallel BS number. More

recently, BSI has decided to dispense with dual numbering on the grounds that the standards will be best known by their international identity, e.g. BS ISO/IEC 10641 : 1991 where ISO/IEC 10641 : 1990 is the number and date of the international issue.

Also published nowadays are British Standard Implementations, simply comprising the international text with a standard front and back cover, and an indication of the BSI committee responsible. Such a British Standard can be made available approximately 6 weeks after international publication.

2.5.3 CEN and CENELEC

At European level, BSI represents the UK in the European Committee for Standardization (CEN), the counterpart of ISO, and the European Committee for Electrotechnical Standardization (CENELEC), the counterpart of IEC. Both CEN and CENELEC originated in the early 1960s and draw their membership from the respective national bodies within the 18 EC and EFTA countries.

As voluntary associations of ISO/IEC members, CEN and CENELEC aim to harmonize their members' national standards wherever possible on the basis of ISO and IEC work.

CEN and CENELEC, like their members, are not empowered to compel anyone to use their standards. The standards that are adopted therefore remain voluntary unless the law intervenes.

2.5.4 ENs, HDs and ENVs

The main types of CEN and CENELEC publication are European standards (designated EN), harmonization documents (HD) and European prestandards (ENV). ENs and HDs constitute CEN and CENELEC standards, whilst ENVs are prospective standards for provisional application, akin to BSI Drafts for Development.

An EN carries the obligation on CEN or CENELEC members to implement it at national level by giving it the status of a national standard and by withdrawing any conflicting national standards. The technical content of an EN is therefore presented in identical form in each country and is of equal validity (except, possibly, in EFTA countries whose members had not supported its adoption). A HD carries the same obligation to withdraw any conflicting national standards but public announcement of its number and title is otherwise sufficient. HDs are created when it is not necessary to change an EN into a national standard – as in the case when a CEN or CENELEC member has already adopted the ISO or IEC standard being endorsed in Europe – or impracticable, and particularly if agreement is subject to the acceptance of national technical deviations.

2.5.5 Sector arrangements

CEN and CENELEC have the facility to administer, or formally to associate with, such other organizations as may exist on a sufficiently authoritative and participative basis for the purpose of preparing standards in particular sectors. The European Coal and Steel Community used to maintain a separate, official committee structure for drawing up its iron and steel standards (issued then as 'Euronorms'). Now, instead, it sponsors ECISS, the European Committee for Iron and Steel Standardization, administered by CEN. UK input to ECISS is concerted within the BSI Iron and Steel Standards Policy Committee.

Also separately administered by CEN is the European Workshop for Open Systems (EWOS).

Two 'associated bodies' are recognized by CEN as competent to conduct all preparatory standard work in their fields prior to formal CEN voting: ACEMA, the European Aerospace Manufacturers Association, and the Western European EDIFACT Board, working on electronic data interchange.

A third European standards organization, quite separate from CEN and CENELEC, the European Telecommunications Standards Institute (ETSI) was formed in 1988 at the initiative of the Schweizerische Poste Telephon Und Telegraphonbetriebe (PTT) organization, the European Congress for Posts and Telecommunications (CEPT). It relies on direct membership from all interested bodies and is active in formulating standards across the whole range of telecommunications systems.

Joint arrangements have been agreed with CEN and CENELEC to avoid duplication of effort and BSI has arranged with the Department of Trade and Industry to coordinate UK interests in ETSI work on telecommunications terminal equipment standards.

2.5.6 Assisted international travel

The benefits of European harmonization will primarily reward the efforts of those who work hardest to achieve it. European work takes priority in the BSI standards programme. In order to encourage UK participation in international and particularly European standards work, the government, through the Department of Trade and Industry, provides a contribution towards the travel costs of certain UK participants attending international and European standards meetings. Details may be obtained from BSI Standards, 2 Park Street, London, W1A 2BS.

2.6 Removing trade barriers within the European Community

2.6.1 The old approach

An ambitious European Community programme intended to eliminate technical barriers to trade was launched in 1969. Directives issued under Article 100 of the Treaty of Rome established free circulation objectives for member states, linked to detailed appendices setting out technical requirements. Keeping these appendices up-to-date proved an unexpectedly heavy burden, the flow of new directives dried up and the Commission reviewed its policy 10 years later.

2.6.2 The low-voltage directive

As an exception to normal practice, the 1973 low-voltage directive was drafted in such a way that national standards harmonized through CENELEC would provide the detailed criteria for assessing the safety of a wide range of products, against a list of the minimal essential requirements to be taken into account. Much of the work of CENELEC has since been directed towards providing the necessary standards, mostly in the form of HDs, as far as possible by endorsement of pre-existing IEC standards.

2.6.3 Mutual recognition

The Cassis de Dijon judgement in 1979 established the principle that any product lawfully produced or marketed in one member state must be admitted to the market of any other member state by virtue of Article 30 of the Treaty of Rome (general prohibition of quantitative restrictions on imports between member states and all measures having equivalent effect), unless Article 36 can be invoked (justification of restrictions on grounds of public morality, public policy, protection of health and life, etc.). Directives following the 1985 new approach now promulgate essential requirements as a harmonized basis for national regulations and look to the provision of voluntary safety standards that will not fall foul of safeguard clauses or the general application of Article 36.

The principle of mutual recognition was restated in the Commission's 1985 White Paper on completion of the internal market, which first listed the programme of community measures to be adopted no later than 1992:

'In cases where harmonization of regulations and standards is not considered essential from either a health/safety or an industrial point of view, immediate and full recognition of differing quality standards, food composition rules, etc.

must be the rule. In particular, sales bans cannot be based on the sole argument that an imported product has been manufactured according to specifications which differ from those used in the importing country. There is no obligation on the buyer to prove the equivalence of a product produced according to the rules of the exporting state. Similarly, he must not be required to submit such a product to additional technical tests nor to certification procedures in the importing state. Any purchaser, be he wholesaler, retailer or the final consumer, should have the right to choose his supplier in any part of the community without restriction. The commission will use all the power available under the Treaty, particularly Articles 30-36, to reinforce this principle of mutual recognition.'

2.6.4 The new approach

Directives under the new approach are based on the new Article 100a introduced by the Single European Act, no longer dependent on unanimity in the Council of Ministers but subject to the requirement that the Commission, in its proposals concerning health, safety, environmental protection and consumer protection, will take as a base a high level of protection. Under these directives:

- (a) legislative harmonization is limited to the adoption of essential requirements only;
- (b) preparation of supporting technical specifications is entrusted to standards organizations;
- (c) such technical specifications maintain their status as voluntary standards;
- (d) but national authorities are obliged to recognize products conforming with harmonized standards as presumed to conform with the essential requirements.

By January 1993, at least the nine new approach directives listed in appendix A will enter into force, through the flexible transitional arrangements in most instances. In each case, it seems unlikely that trade will be facilitated until harmonized standards become available. Those most keen to trade are taking the initiative in setting the standards.

2.6.5 CE marking

The low-voltage directive provided for nominated bodies' certification mark and test results to be accepted by the relevant national authorities. The new approach directives instead provide for a single, distinctive marking (the letters 'CE') (see figure 2.2) to be displayed on products marketed as conforming with the applicable essential requirements. Such marking may be self-certified and might be sufficient for a frontier official, but it is not a quality

mark and could mislead purchasers and end users if the criteria underpinning it were not immediately apparent. Nor is it expected to reduce customer demand for voluntary certification of product conformity with standards.

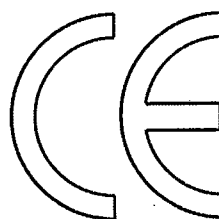


Figure 2.2 European certification mark

2.6.6 Procurement directives

Article 7 of the Treaty of Rome prohibits discrimination on grounds of nationality within the scope of application of the Treaty. Liberalization of public procurement is seen as an important element in establishing the single market, i.e. an area in which the free movement of goods, persons, services and capital is assured.

Under the amended public supplies and public works directives, and the new utilities directive, those responsible for inviting tenders for contracts above certain values are required to define their technical specifications by reference to national standards implementing European standards, where these exist, subject to derogation. On this basis, no authority likely to be bound by the outcome can afford to ignore CEN/CENELEC developments.

In the absence of suitable European specifications, the utilities directive text envisages that contract specifications should as far as possible be defined by reference to other standards having currency within the community. The supplies and works directives indicate more explicitly that in this case it is appropriate to make reference in order of preference to:

- (a) national standards implementing international standards accepted by the country of the contracting authority;
- (b) other national standards (and national technical approvals) of the country of the contracting authority;
- (c) any other standard.

Contracting entities bound by the directives are advised, however, to qualify with the words 'or equivalent' any specification requirement referring to a purely national standard, in order to be able to verify compliance with their technical conditions without running the risk of unlawfully restricting the initial opportunity to tender.

2.7 Certification

2.7.1 General

The purpose of certification is to provide third party assurance that standards are being met. The principal parties concerned with the marketing of goods are the manufacturer and the purchaser. The manufacturer's declaration of conformity to standards is referred to as first party or self-certification whereas the purchaser's certification is known as second party certification. third party certification schemes are operated by independent test laboratories.

2.7.2 Product certification

Product certification requires testing resources and relies on standard test methods that will be accepted, often coupled with factory inspection and market surveillance regimes as in the case of the BSI Kitemark and Safety Mark.

The main advantages of buying such certified products are:

- (a) independent assurance that they comply with the standard in question and have been manufactured under a strict system of quality control;
- (b) reduction of goods inward inspection;
- (c) easier selection for fitness-for-purpose.

2.7.3 Capability assessment (quality system certification)

Capability assessment is a different kind of certification, confidence in a firm's ability consistently to meet customers' requirements being promoted through its registration on the basis of assessment to the appropriate Part of BS 5750 (ISO 9000/EN 29000).

2.7.4 Quality systems

Confidence in third party schemes is progressively reducing the continuing need for second party (purchaser) supplier assessment arrangements.

2.7.5 Electronic components

ISO 9000 (BS 5750) should not be confused with BS 9000, the basis of the national, European and now international certification and approval system for electronic components (see appendix C).

2.7.6 Support for voluntary certification

In a society where most standards are applied on a voluntary basis and in a market environment where brand name reputation is pre-eminent, independent product certification has traditionally been little supported by manufacturing industry in the UK. It is government policy not to make standards mandatory, unless there are exceptional grounds for doing so in the interests of health or safety, and only

one example exists of certification marking to a standard as a mandatory requirement through regulations: the Kitemark on the helmets sold for motor cyclists on the roads.

The 1982 White Paper on standards, quality and international competitiveness, however, identified the encouragement of certification schemes as a principal way in which government action could enhance the level of quality performance and hence the efficiency and competitiveness of British firms. The UK's major competitors, it was observed, were more accustomed to certification as a requirement of their home markets, and government saw an urgent need for more certification schemes to be established to promote quality in the UK.

To underpin this expansion by increasing customer confidence in the process of certification, the National Accreditation Council for Certification Bodies (NACCB) was established in 1984. To be eligible for accreditation, third party certification bodies are required to meet criteria derived from the relevant ISO/IEC Guides, mostly now implemented in Europe in the EN 45000 series of standards. Creation of the NACCB has resulted in the formation of the Association of Certification Bodies (ACB), providing for the first time for collective representation of certifiers in national forums, in particular the Council itself.

Supporting arrangements for the national accreditation of testing laboratories had been established in 1980 and previous institutions such as the British Calibration Service (BCS) and the National Testing Laboratory Accreditation Service (NATLAS) now form part of the National Accreditation and Measurement Service (NAMAS), of the Department of Trade and Industry. It assesses, accredits and monitors calibration and testing laboratories, again in accordance with EN 45000 criteria. NAMAS accreditation is voluntary and open to any UK laboratory including independent commercial laboratories or those which form part of a larger organization such as a manufacturing company, educational establishment or government department.

2.7.7 European aspirations

Adoption throughout Europe of the EN 29000 and EN 45000 series of standards should facilitate bilateral and multilateral arrangements for mutual recognition of certification activities in different countries in order to reduce barriers to trade. Within the loose framework of the new European Organization for Testing and Certification (EOTC), coherent sector arrangements are expected to take shape on the basis of agreements reached amongst testing and certification bodies in response to the needs of the market place subject to minimal

central control. It is important for individual sectors of industry, and their trade associations, to involve themselves. Initial UK input to the EOTC has been organized through the BSI Board Committee for Quality Policy.

The goal is to enable industry to secure the form of testing or certification needed for the European market from one source, knowing that this will provide the passport to the whole of the EC/EFTA economic area. Moreover, since the criteria assisting mutual recognition – EN 29000 and EN 45000 – are

based on international agreement, they should, in the longer term, facilitate the removal of technical barriers to trade worldwide.

In practice, it will still be most important to provide the means of assurance that the customer requires. Different customer attitudes and preferences, built up over generations, are likely to persist and customers in different countries will surely continue to look for the certificates and marks with which they are familiar.

Section 3. Quality management

3.1 Quality and design

UK quality in the industrial context began because of a military need in World War I to ensure the safety and interchangeability of products and spares. It concentrated, however, on the inspection of goods against specification and drawing. Later, it was realized that this only separated conforming from non-conforming components and that it would make more sense to prevent non-conforming components being produced, but it was some years after World War II before quality assurance was introduced into the design stage. This has been attributed to the general lack of realization that there are two major aspects of quality, the quality of the design/specification which concerns the degree to which the design suits the purpose, and secondly the quality of the conformance of the parts produced to meet the specification. Poor execution can easily debase a good design but a poor design can never result in high quality. Other possible shortcomings in company organization are:

- lack of feedback from production and customer or user;
- isolation of design from other company functions;
- inadequate design procedures;
- insufficient information available to the designer.

The introduction of a quality system covering all aspects of a company's operations can alleviate most of the above deficiencies. A quality system which accords with BS 5750 : Part 1 may help to achieve a quality product although it will not on its own provide the complete solution. Although the written procedures cover responsibilities and methods for production and control from design through the process and delivery they do not cover the cost effectiveness of these operations.

An assessor is only concerned that the procedures meet the requirements of the appropriate Part of BS 5750 and that the company are working to them, he is not concerned whether these are the most efficient procedures nor whether the quality of design could be improved.

Nevertheless a quality system of this type is recommended as an essential base for benefits over and above those arising from successful assessment. The discipline of having to describe, in written form, how things are done and by whom can have the effect of revealing outmoded practices, inefficient methods and sometimes lack of clear responsibility. It can lead to better communication, better management control, improved working conditions, greater productivity and increased profit.

3.2 Quality and standards

One of the most modern improvements in the use of standards is the development of quality systems at all levels within the business. Total quality management is as demanding on the standards organization as it is on the workforce.

The standards function and the quality assurance function are expected to work in collaboration as they are interdependent. Conversely the maintenance of standards depends on the diligence of the quality audit team providing feedback when non-compliances are encountered.

Standards have three main roles in quality assurance.

- (a) To provide design specifications. Quality assurance starts with good design.
- (b) To provide tests which form the basis of quality control and, if required, product certification (conformity assessment).
- (c) To provide information on the management technique of quality assurance itself and criteria against which a company's quality management can be assessed.

Aspects (a) and (b) are covered by standard specifications and test methods which will depend on the product or service concerned. Aspect (c) is covered by an important group of British Standards published as BS 5750.

3.3 National and international standards on quality systems

3.3.1 General

BS 5750, 'Quality systems', forms a cornerstone of the National Quality Campaign and is the reference basis for the 'Register of Quality Assessed United Kingdom Companies' issued by the Department of Trade and Industry (published by HMSO). Previous editions of the Parts of BS 5750 were the basis for the development of the ISO 9000-9004 series of international standards which deals with quality systems and management and, more recently, EN 29001/2, the European regional standard on quality systems.

BS 5750 : Parts 0, 1, 2 and 3, ISO 9000-9004 and EN 29000-29004 are identical.

The latest revision of BS 5750 takes account of the international agreement involved in this development and has been published as a triple-numbered standard identical with the international standards. They, in turn, have become the basis for

harmonization within the European standard body CEN/CENELEC and hence among the EEC and European Free Trade Association (EFTA) countries. BS 5750 is therefore of great significance in world trade. It is issued in Parts, as follows, not to reflect different levels of quality but to specify different scope.

3.3.2 BS 5750, EN 29000, ISO 9000 and AQAP

Part 0 Principal concepts and applications

Section 0.1 (EN 29000/ISO 9000) Guide to selection and use

Clarifies the principal quality concepts and provides guidance on the selection and use of the other Parts of the standard both for internal quality management purposes and for external quality assurance purposes.

Section 0.2 (EN 29004/ISO 9004) Guide to quality management and quality systems elements

Describes a basic set of elements by which quality systems can be developed and implemented for internal quality management purposes. The selection of appropriate elements and the extent to which these elements are adopted and applied by a company will depend on factors such as the market being served, nature of product, production process and customer needs. The object is to minimize cost of the quality project while maximizing the benefits.

Part 1 (EN 29001/ISO 9001) Specification for design/development, production, installation and servicing

Specifies quality system requirements for use where a contract between two parties requires the demonstration of a supplier's capability to design and supply a product or service. It is used when the contract specifically requires design effort.

Part 2 (EN 29002/ISO 9002) Specification for production and installation

Specifies quality system requirements for use where a contract between two parties requires demonstration of a supplier's capability to control the processes that determine the acceptability of the product or service supplied against an agreed specification. It is used when the requirements are stated in terms of an already established design or specification.

Part 3 (EN 29003/ISO 9003) Specification for final inspection and test

Specifies quality system requirements for use where a contract between two parties requires demonstration of a supplier's capability to detect and control the disposition of any product non-conformity during final inspection and test only.

Part 4 Guide to the use of BS 5750 : Parts 1, 2 and 3

For those intending to install quality systems to provide quality assurance for certification or company purchases. Latest national and international quality systems requirements, applicable over a range of organizations including service organizations.

These standards are also equivalent, with some minor differences, to the NATO allied quality assurance publications AQAPs 1,4 and 9 which superseded Ministry of Defence standard DEF STAN 05-21 to 05-29. A company which is registered to BS 5750 should have no difficulty in being assessed to the equivalent AQAP and vice versa.

BS 5750 is essential to a company's quality activity whether it is used for external assessment or for internal quality management, i.e. a quality audit. It is expected that it (or its international equivalents) will supersede the AQAP series. Quality audits conducted on a supplier by the purchaser's representative or by third party assessment will test the effectiveness of the output of the company's standards function. Failure to carry out effective documentation and maintenance of standards policies may result in failure to satisfy the purchaser or assessor and thus in loss of business.

3.3.3 Handbook on quality management systems

While British Standards on quality management are referenced individually and may be obtained individually, some have been classified in the following BSI handbook, which brings them together under a hard cover and forms a convenient and economical way of obtaining and holding them.

Handbook 22 Quality assurance. Handbook 22 includes standards which can be grouped under three headings.

- (a) Terminology standards which set down agreed terms and definitions in current quality assurance practice.

BS 4778 Quality vocabulary (in two Parts).

BS 5233 Glossary of terms used in metrology.

- (b) Basic or generic standards which are written in the form of guides (not involving contractual requirements).

BS 4891 A guide to quality assurance.

BS 5760 Reliability of constructed or manufactured products, systems, equipments and components (in five Parts).

BS 6143 Guide to the economics of quality (Part 2).

BS 7000 Guide to managing product design.

BS 7229 Guide to quality systems auditing.



Documents

Document Sharing Hub

(c) Definitive system specifications (with guides) for use in contractual situations.

BS 5750 Quality systems (in five Parts).

BS 5781 Measurement and calibration systems (in two Parts).

BS 4778 and BS 5233 define terms used directly in the other standards listed in (b) and (c) above. Wherever possible, terms and definitions from EOQC, ISO and IEC publications have been adopted. An appendix in BS 4778 : Part 2 makes reference to other British Standards and ISO glossaries that contain additional terms relating to quality assurance.

BS 4891 is a basic (source) document dealing broadly with the whole field of quality assurance. Its 14 contents headings form the basic structure of the other standards listed in (b) and (c) above.

BS 5760 is currently in five Parts. Part 0 is an introductory guide to the principles of reliability; Part 1 discusses the essential features of a comprehensive reliability and maintainability programme and is concerned mainly with what has to be done and why, when and how. Part 2 recommends general procedures for the assessment of reliability; Part 3 contains authentic practical examples; Part 4 gives guidance on specification clauses concerned with the achievement of reliability. BS 6143 gives advice on determination of costs associated with defect prevention and appraisal activities, failures, and the operation of quality related cost systems. BS 7000 gives guidance on the management of product design based on five prerequisites:

- (a) commitment to good product design at all levels of management;
- (b) motivation of staff involved;
- (c) clear objectives;
- (d) adequate resources;
- (e) organizational systems.

BS 7229 gives guidance on auditing quality systems which can be applied to:

- (a) a quality systems audit carried out by a company on its own;
- (b) an audit by one organization on another;
- (c) third party audits by independent agencies.

3.4 European quality system

The European quality policy has five elements.

- (a) Producers are encouraged to have quality systems which conform to EN 29000.
- (b) Testing and certification facilities should meet the criteria provided by the EN 45000 series of European standards and be accredited wherever possible.

(c) Information as to testing and certification facilities should be made available through development of the database 'Certificat'.

(d) Legislation under European directives should involve conformity assessment procedures as a standardized basis.

(e) The European Organization of Testing and Certification (EOTC) is based on the principle of bringing together the existing facilities as considered appropriate to each section.

As 1992 approaches, companies are constantly seeking to improve their export markets. They naturally want to know if registration to BS 5750 is going to be sufficient. BS 5750 has been in use since about 1980 and the consequential international version ISO 9000 preceded the European document EN 29000 that was published in 1987. European countries are adopting these systems but it may be some time before registration schemes are widespread on the continent. The advantages of approval to BS 5750 have therefore to be considered in the light of the situation in each of the possible target markets.

The EN 29000 series has become the national standard in all CEN countries, and Germany and France are both developing schemes similar to those operated by BSI and other organizations in this country. The fact that a firm is a Registered Firm in accordance with BS 5750 may not mean much on the continent yet as the principles of the scheme have not yet become accepted as they have here.

On the other hand, the registration of overseas companies in the home market is a reality. BSI have over 100 such firms registered under BS 5750.

It is important to realize that it is necessary in some European countries to be able to show compliance with a national product standard in order to achieve maximum market penetration. Approvals such as IMQ, DIN, VDE, AFNOR, etc. have been the norm for generations and the presence of a 'mark' on the product is essential.

Outside Europe each country has to be examined separately. In parts of the USA, local laws require getting approval from a local testing laboratory but 'Listing' by one of the better known laboratories is preferred (UL, FM, ETL, etc.). In Canada recent legislation may now allow USA certification to be accepted. Neither Canada nor the USA has moved along the 'Registered to BS 5750' route. In Japan, ISO 9000 is recognized but assessment to it is not a way into the Japanese market.

BS 5750 therefore has a potential value in Europe but ISO 9000 has not been universally adopted throughout the world.

3.5 Installing a quality system

3.5.1 Is it expensive?

BS 5750 has been written in a form which is ideally more suited to large companies that deal with relatively few contracts of large value. Smaller companies that have a large number of small value orders may find that some interpretation and guidance is necessary. Installing a quality system does not need to cost a great deal, although it does need planning carefully. Experience has proved that the cost is moderate and in a matter of months it can be saved by more cost-effective methods of operation. Obtaining registration to enhance the company image is an additional bonus to improving the efficiency of operations. First reflections after reading the standard may leave one feeling slightly confused and fearful of the effort required and the volume of paperwork likely to be produced. This is a common reaction but fortunately usually unconfirmed.

Establishing a quality system is well worth doing. Most companies are already doing the right things but lack the formality of written standards and records. Indeed, in many small companies having little or no formal documentation, the provision of a quality system can produce dramatic improvements.

A quality system is no more than good management and should cover all aspects of the company's operations because there is no sense in having one system for quality matters and another for the remaining operations.

3.5.2 Economics of quality control

BS 6143, 'Guide to the economics of quality', is in two Parts: Part 1, 'Process cost model which applies quality costing to any process or service'¹⁾ and Part 2, 'Prevention, appraisal and failure model' (PAF) being a revised version of the 'traditional' method used in manufacturing industries.

Total quality management (TQM) requires the management of processes. The new standard emphasizes this and points out the contribution required from every person within the organization.

The process model is shown in figure 3.1 of the present standard. Cost elements are recorded as people, equipment, materials and equipment and each is identified with a cost of conformance (COC) or a cost of non-conformance (CONC). Some useful examples of the technique are given in appendices to BS 6143.

The view is expressed that allocation of costs to prevention, appraisal or failure tends to divert from the purpose of cost reporting, which should be the

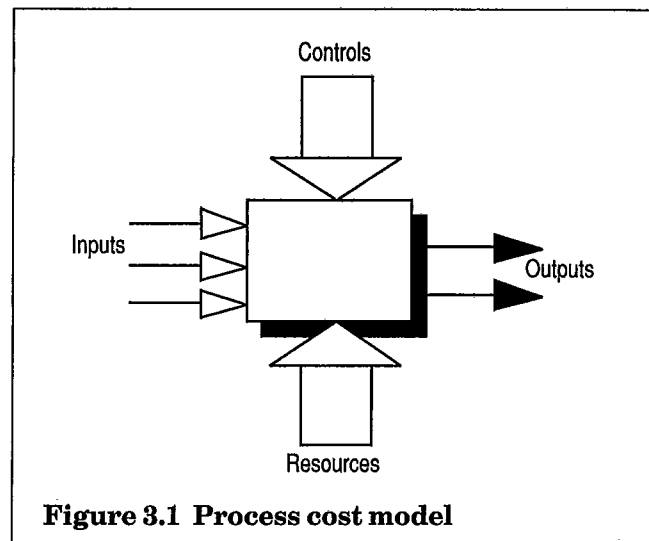


Figure 3.1 Process cost model

constant drive to achieve lower costs. The true value of cost reporting is the opportunity to measure performance and introduce and monitor changes.

3.5.3 What should a quality system consist of?

The three most important aspects of a quality system are availability of documentation, control of purchasing and calibration of measuring and test equipment.

There are a few basic points about documentation to consider. The purpose is to convey the information which people need to carry out their job effectively. It is axiomatic that the documentation must be easy to read and understand; if it is not, nobody will bother to read or use it. This means that documents should be short and to the point. To meet the requirements of BS 5750, documents may be categorized as belonging in three groups: a quality manual, a set of procedures and work instructions.

A *quality manual* comprises about eight pages and gives a short description of the company and its capabilities together with statements of its quality policy and systems, workmanship, control of amendments and reissues, and the organization and authority for implementing the quality system. The quality manual ends with a precis of each of the procedures. As well as meeting the requirements of the standard, such a quality manual can form a brochure for sending to prospective customers providing the reasons why they should buy the company's products.

A *set of procedures* is required which describes how the company operates, who has the responsibility for what actions and what books and forms are used and for what purpose. The procedures should not contain detailed information which is only of concern to a few. Such information should be contained in a group of *work instructions*.

¹⁾ In preparation.

support the procedures and need only be issued to those concerned whereas the procedures are the concern of all personnel.

3.5.4 Writing the documents

It is usually best if procedures are written by professionals who have experience in standards and quality systems. The first step is to find out and record in writing how the company operates. Information is needed from all departments and sections if a true picture is to be obtained and this is more likely to be gathered by an outsider than someone with vested interests in departmental operations. As people are naturally resistant to change and probably will have been doing the right things anyway, it is sensible in the initial stages to restrict changes to those essential to the requirements of the standard. Further improvements will undoubtedly be possible but they can be deferred until the benefits of the quality system become obvious. There is no doubt that seeing in writing what happens has a very salutary effect and can lead to staff making their own proposals for improvement.

Procedures need to meet the requirement of the standard in a way which will improve not hinder the functioning of the organization. They should allow room for manoeuvre wherever it is sensible to do so, in order to meet changing situations which arise. After all, the purpose is to increase the competitiveness of the company not to cripple it with unnecessary additional costs. Procedures must be introduced with common sense and it is not feasible to cover every possible situation. However they will need updating regularly to meet changing circumstances such as market forces, process development, and personnel turnover as well as improved control revealed by retrospective examination of the procedure in use. In this connection, it is sensible for each page to have its own issue number so that amendments can be made easily by issuing new pages. This is much safer than relying on individuals to make their own amendments.

Work instructions are best prepared by the company itself as they largely comprise the technical know-how. The work instructions should provide information which the operative is unlikely to know from his normal training or may need to be reminded of because of its complexity, e.g. instructions for internal calibrations, instructions on how to operate a special machine, packaging instructions to ensure safe delivery.

Implementing a quality system can lead to cleaner and tidier workplaces and stores which are more

pleasant to work in and therefore more productive. It also leads to better communication across the company, leading to better human relationships.

3.5.5 Company quality procedures

3.5.5.1 General

A summary of a typical set of procedures which meets the overall requirements of the company, as well as those of BS 5750 : Part 1, is given below. Some of the procedures will not apply to all companies but the majority will.

Advice on the format and content of each of the following can be found in more detail in later sections of this publication. The methods described therein can be selected and combined to produce a quality handbook for your own organization.

3.5.5.2 Documentation

Details the actions to be taken to ensure that the quality manual, the associated procedures and relevant British and other standards are kept up to date. It also covers the control of company drawings including withdrawal of superseded drawings before issue of new drawings.

3.5.5.3 Enquiries and quotations

Ensures that a proper record of quotations made to customers is kept for use in handling both written and telephone enquiries. A record of any costing exercise is also kept, together with all correspondence, drawings, etc. at least until the quotation is accepted or rejected.

3.5.5.4 Customer order, entry and control

Lists the action to be taken on receipt of the customer's order through to completion of the order. It also covers the checks to be carried out and states who is responsible for each action or check.

The aim is to ensure that the customer's order is complete and correct, and then to enter it correctly into the work's system. It also ensures that amendments to the order are dealt with correctly and that when the order is completed, customer quality record files are raised and all associated records filed.

3.5.5.5 Customer drawings, entry and control

Amplifies the customer order procedure with respect to control of customer's drawings including any new or updated drawings subsequently received. In the latter case, the procedure ensures that the superseded drawings are withdrawn before issue of the new. It also ensures that on completion of the order, the drawings are put in the customer quality record files or returned to the customer if so requested.

3.5.5.6 Customer-supplied materials and tooling

Ensures that customer-supplied materials and tooling are included in the quality system and are clearly identified and kept segregated at all times. Details are entered in the customer-supplied materials book and the tooling book.

3.5.5.7 Quality plans

Ensures that the correct level of quality assurance will be applied to each customer order through the appropriate quality plan.

Quality Plan 0 covers the case where the raw material is not in the quality system.

Quality Plan 1, normal commercial, involves all the procedures except those for material traceability and the provision of a certificate of conformity, which are covered by Quality Plan 2.

Quality Plan 3 covers the situation where a customer wishes to verify that a purchased product conforms to specified requirements.

Quality Plan 4 applies when a customer requires an individual quality plan for his contract.

3.5.5.8 Traceability

Covers the extra requirements when material traceability is involved, including work instructions, purchasing, marking and records.

3.5.5.9 Calibration of measuring and test equipment

Lays down the actions and controls required to maintain, within prescribed limits, the accuracy and condition of all measuring and test equipment used during manufacture, assembly and test of company products, including equipment privately owned.

3.5.5.10 Design policy and control

Ensures that new products are developed from existing products to meet individual customer requirements, and that their performance figures and tests are obtained and recorded. It also ensures that any regulatory and safety requirements are met.

3.5.5.11 Purchasing including vendor assessment

Ensures that purchased materials, items and services meet the required quality levels and satisfy contract requirements. It also ensures that purchase orders clearly specify what is required including the appropriate level of goods inward inspection. Finally, it includes the selection and approval of suppliers and subcontractors through vendor assessment.

3.5.5.12 Goods inward control

Details the methods and responsibilities for receiving goods including customer-supplied materials and tooling, to ensure that, as far as possible, unsatisfactory goods do not reach production areas and functions.

It details the various levels of goods inward inspection, known as goods inward categories (GICATS). It covers acceptance and rejection procedures including identification, labelling and location.

3.5.5.13 Stock control, storage and handling

Details the methods for stock control, storing and handling material and parts, to ensure the necessary identification, preservation and segregation of material and the provision of handling methods to prevent misuse, damage or deterioration. It also covers the disposal and recording of surplus material on completion of manufacture.

3.5.5.14 Manufacture, inspection and test

Covers the use of jigs and fixtures, and the methods of inspection which are required to ensure that the products are in accordance with the customer's requirements and are to the required quality. It also covers identification, inspection status and segregation together with procedures for acceptance or rejection.

3.5.5.15 Non-conforming items and corrective actions

The aim is to ensure that rejected items cannot inadvertently be returned to the shop floor when they should have been scrapped or remedial action taken. It details the methods for determining what remedial action should be taken including, where appropriate, obtaining the approval of the customer as design authority, for the proposed action.

It provides for continuing analysis of concessions granted, material scrapped, reworked, modified or otherwise repaired, to determine the causes and to decide on the corrective actions.

3.5.5.16 Preservation, packaging and delivery

The objective is to ensure that, as far as possible, the product as received by the customer is to the level of quality to which it was manufactured, i.e. that it is in no way damaged during delivery.

3.5.5.17 Quality records

This procedure requires that customer quality record files contain the following and are to be kept for a minimum of 5 years:

- customer orders and drawings;
- associated purchase orders and traceability records;

enquiry/estimate forms, works orders, route cards;
 certificate of conformity;
 defect report plus records of corrective action;
 customer complaints.

3.5.5.18 Quality audit and system review

Details the audit and review procedures for checking the company's quality system over a period of 12 months, or less if the situation demands. It also covers the procedures to be followed to correct the quality system if defects or shortcomings are discovered.

3.5.5.19 Training

Covers the actions necessary to ensure that the training needs of personnel involved in inspection and other quality functions are catered for, planned and recorded.

3.5.5.20 Assistance to customer representatives

Covers the provision of assistance to the customer's representative so that he may evaluate the adequacy of the company's quality system.

It indicates that prior notice is required of any visit and that any information obtained or made available is to be treated as confidential.

3.6 Quality assurance and company standards

3.6.1 Company standards

Quality management has become significant in the industrial world. It could even be said to have become a way of life in industries in Japan. More recently there has been increasing emphasis on quality aspects in the UK and Europe. This has led to a greater concern with company standards because of the influence they exert on the control of quality. In particular quality control engineers should examine those standards which define quality systems such as BS 5750, which is identical to the international ISO 9000 and EN 29000 series. Many medium and small companies that previously had little or no interest in standards now need to involve themselves directly. Although it is only in the larger companies, and certainly not in all of them, that a standards department or even a standards engineer will be found, there will almost certainly be a quality manager who is responsible for standards in any organization with ambitions to sell a successful product, particularly if the company also wishes to become recognized as a market leader.

The basis for quality assurance is the control achieved by the cooperation of all concerned in the design and manufacture of the product. An

integrated documentation and specification system, designed to avoid ambiguity and duplication, should define the standards established and expected. This should cover particularly the specification of raw materials and other bought-in parts, control of processes, packaging and proper use of sampling schemes in place of 100 % inspection.

National and international activity in the fields of quality assurance, certification and reliability is so extensive that the quality department should regularly check the company's policies in relation to these activities and it should have a systematic procedure for advising the appropriate departments or managers accordingly.

Although quality audit specifications can be issued in a separate series, other quality requirements such as work instructions or change control are inescapably part of the manufacturing or design process. The quality manual should therefore be designed and compiled so that it can be maintained as an integral part of the normal specification system and relate as closely as possible with BS 5750/ISO 9000/EN 29000.

3.6.2 Certification

Legislation covering health and safety and product liability imposes a requirement on industry to be diligent in the protection of the workforce as well as the customer or consumer. Company and national standards can be used both to ensure that safe practices are maintained and to demonstrate the fact to subsequent enquirers as an assurance.

Some of the largest organizations in this country are not the primary manufacturers or service providers but those who utilize plant and equipment and related spares and consumables. The Post Office, the Ministry of Defence, the public utilities, and many organizations in the chemical and petrochemical, coal and steel industries have very large capital investment in engineering goods but they do not themselves market engineering products/services except, in some cases, through relatively small subsidiary companies or divisions.

It has been common practice for such organizations to produce their own standards, thus imposing a wide variety of extra requirements on their subcontractors or suppliers, particularly if they supply to several of these bodies. Thankfully present trends have seen the rationalization of many of these systems by concentrating on and contributing to the production of national standards. BS 5750 and related certification schemes are an example of the success of this policy to the benefit of the customer and the supplier. Approval to BS 5750 yields many benefits to recoup the effort involved. For example, as well as the bottom line advantage such as reduced wastage and reworking, it

reinforces the quality image of a company to its customers with a resultant increased customer confidence. An additional advantage is the clear signal it gives a company's employees of its commitment to quality.

3.6.3 Public purchasing

Major public purchasing authorities are tending to place more stress on quality assurance and guarantees of satisfactory procedures are requested in many of the contracts they draw up.

The Local Government Act 1987 includes a requirement that, if local authorities wish to carry out certain defined activities using direct labour services, then they must put out contracts to competitive tender. This is called compulsory competitive tendering (CCT). The essential conditions of the Act require that the invitation to tender includes detailed specification of the work to be carried out, and that, if the local authority direct labour unit is awarded the contract, it fully complies with the specification. By January 1994 all seven defined activities must have been subject to CCT. Between 30 and 40 services are already under consideration as additions to the list.

The result is that local authority direct labour services will function more like industrial businesses seeking approvals to BS 5750 or from NAMAS. They therefore need to become as efficient and competitive as possible and registration to BS 5750 could be a means of ensuring that organizations are competing on equal terms.

The areas in which registration is being considered are:

- (a) collection of refuse;
- (b) cleaning of buildings;
- (c) other cleaning (litter, etc.);
- (d) catering (schools, homes, public buildings, etc.);
- (e) repair and maintenance of buildings;
- (f) ground maintenance (grass, etc.);
- (g) highway maintenance;
- (h) fencing;
- (i) emergency services.

3.6.4 Component/material quality

By the regular use of standard components and materials, the task of compiling a history of quality and reliability information is made easier. Inspection methods can then be adjusted accordingly for supplier quality control and routine sampling.

However, when non-preferred or unproven sources or materials are used, the risk of poor quality is increased and no history for assessment of reliability exists. Before there are any additions to a standard range, evaluation testing should therefore be carried out.

Section 4. The management of company standardization

4.1 Introducing standardization

4.1.1 Allocating resources

Standardization does not need to be inhibiting. It can be the medium for removing much of the mystique in such specialized areas as computerization or electronics and is invaluable as a training aid. It can also be used to establish and maintain a corporate identity. The evidence of this latter point is plain to see in the 'High Street', where chain-stores profit by their standardized corporate presentation regardless of their geographic location.

In a manufacturing environment two levels of standardization will be in evidence. The first will be in the concern for the product and will entail participation in the international and national standards-making functions, starting with membership of an appropriate trade association. This should ensure that the product will maintain a proper position in the market and not fall foul of legislation, both domestic and foreign. The second should concern the raw materials and components the product is manufactured from and the procedures used in its manufacture, ranging from design and drawing office practice to the latest quality control systems.

Of necessity, the first level usually demands the resources of the research and development team and involves a significant investment in attending the various committee meetings, which may be anywhere in the country for BSI meetings or practically anywhere in the world for international committees. However, as it is not feasible for a manufacturing company to pay the same attention to attending the committees of all or even a majority of the components and materials that it uses, these aspects are usually attended to by the company standards engineer, who will monitor the development and implementation of the standards for materials and components purchased by the company. These may be anything from electronic components to nuts and bolts. Failure to recognize the importance of either of these two distinct categories of standardization may result in the demise of a product which no longer satisfies the market, or manufacturing methods prone to variation and swings in product reliability and quality.

Although variety reduction is inherent in the methodology of standardization, rationalization of products is a separate and important standardization technique. It is a subsequent activity and must be linked with a desire to capitalize on the standards effort and not be over-emphasized or considered as a starting point in introducing standardization. It may be best left to the appropriate sections of an organization to

conduct their own rationalization based on the standards available.

For industry, commerce or other services quality schemes such as BS 5750 (ISO 9000/EN 29000) give a clear indication of the kind of standards needed to satisfy various certification or assessment bodies described in the following chapters. Health and safety legislation and product liability also impose similar requirements in their demand for relevant data and the necessity for informing users of precautions to be taken in the use of hazardous materials. The implication of all these statutes is the need for constant vigilance and proper information. Evidence is needed in the form of lucid documentation that both can be maintained. It is clear that, particularly in the management of smaller companies, there is much misunderstanding of the value, and even mistrust, of standards-making bodies. One of the aims of this publication is not only to dispel this mistrust but provide a basic guide as to how standards can be introduced to improve profitability, illustrating how to use them effectively and to best advantage.

4.1.2 Directing standardization effort

The scope and opportunities for standardization are extensive and demand will more often than not exceed resources (see figure 4.1). The ultimate success of standardization in an organization will be realized when every person has the initiative and the will to apply standards in his own sphere of operations, with the professional assistance of the company standards engineer or experts from trade associations or other institutions. Although it is not always possible to justify any particular exercise on the basis of direct cost savings, economics are the basis of business and therefore standards exercises should be conducted with firm objectives. As well as being technically essential, standardization is otherwise economically viable due to benefits associated with control of manufacture, health and safety, quality management, contribution to sales and environmental control and protection.

Difficulties with costing standardization may be experienced because the benefits are frequently intangible. The costs may therefore have to be considered on the same basis as an investment. The position of the management of the standards function in the organization should be recognized as a restrictive factor. It may come under the development or production engineering departments of the organization or it may be separated as an essential service department. The objectives and measurement of performance should be considered in terms of the corporate benefits.

The objectives will naturally vary according to the type of industry or organization. Some companies

Application	Method	Purpose	Benefits
Management control	Directives, procedures, codes of practice	To communicate rules from management, Company and product rationalization	Efficient and effective control, better industrial relations
Environment	Codes of practice	Health and safety standards that relate to the environment	Health and safety
Plant and equipment	Catalogue, Specifications, standards, codes of practice	Identify and control plant, its maintenance and use of spares	Process control, Plant management and efficiency, environmental control
Design	Specify Materials, components, Processes and codes of practice	Meet market requirements, Maintain optimum design possibilities, product liability, manufacturing efficiency	Product quality and reliability, environmental protection, health and safety
Drawing office	Use of design and manufacturing standards, classification and coding	Information retrieval, design codes of practice, variety control	Better product design, design control
Material control	Catalogue, identification coding, handling codes of practice	Stock control, quality assurance, health and safety	Availability of parts, reduced stock investment, COSHH controls
Purchasing	Purchase and material specifications, coding	Purchase specification supplier approval, quality control	Quality and availability of components and materials at the right price
Manufacture	Specifications, codes of practice, coding, health and safety	Production control, education and training, quality control, testing	Productivity, quality, health and safety of employees
Packaging	Codes of practice, coding	Protection in transit, cost effectiveness	Customer satisfaction
Sales	Codes of practice, instruction manuals	Communication with customer, quality assurance	Delivery, better customer relationships
Accounting	Catalogue, Procedures	Control of capital and depreciation	Financial control
All	All	Quality management	To employees, customer and company

Figure 4.1 The use of company standards

consider that they should be involved directly in standardization at international and national level; others may be able to justify only an in-house programme. Between these two extremes are trade associations, professional institutions and societies, all of which have the purpose of representing a number of individuals or groups to participate in standardization. Fundamental to the benefits of using standards is their facility to create order and to communicate. Establishing a framework in which people can communicate is of prime importance to the chance of success. It is vital to produce a recognized documentation system to record decisions as they are made and record the organization structure which is going to be essential to the authority of those decisions (see figure 4.2).

Each organization should decide where, when and how to participate as a user and as a manufacturer. As a user we may be interested in the commodities purchased in quantity and in those items or materials critical to the product in terms of quality, interchangeability or availability. The manufacturer on the other hand is interested in technical and commercial considerations, and in involving the design and sales functions, usually via the appropriate trade association and BSI, in the formulation of the standards in line with the market requirements and the organization's own ability to fulfil them.

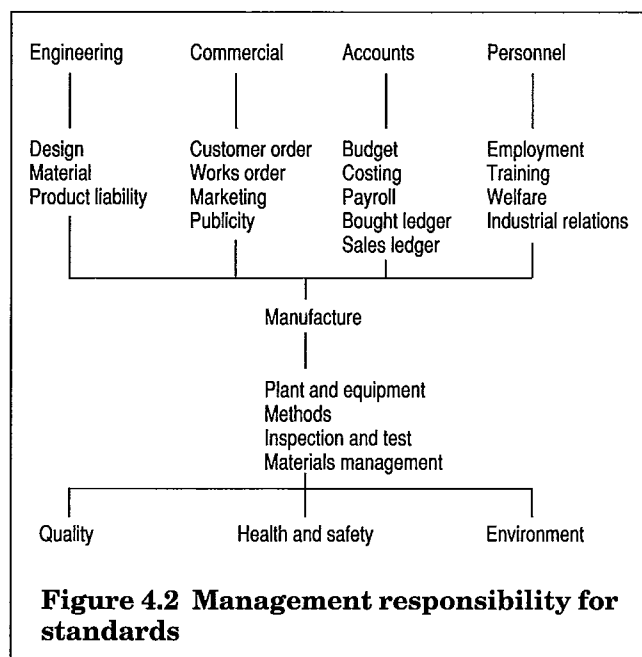
Apart from being administrative, company standards are usually internal, the task being biased towards providing ways and means of implementing international and national agreements and regulations.

The user's involvement extends beyond the international and national levels into every works office, shop, or home. As the company progresses, priorities are more difficult to allocate. In such cases it is essential that standardization exercises show benefits in proportion to their cost. In practice, standardization can be more comprehensively applied in the small firms than in the larger ones, as with determination from the Board it is easier to obtain cooperation without protracted interdepartmental discussion and inevitable compromise.

4.1.3 Size of the business

A survey conducted in 1989 showed that, in the UK, 96 % of all businesses employ less than 20 people and account for 36 % of all people employed.

Companies employing less than 200 people account for 60 % of total employment. These statistics reveal a number of challenges that are regularly presented to British industry in applying techniques such as standardization or quality management. While it is



obviously important that the top 30 companies should not overwhelm or unduly influence the very large number of smaller businesses, their contribution to research and development must be recognized and encouraged, particularly if the means are available to redistribute their knowledge. Standards, whether they be company, national or international, provide this vehicle. It is obvious from the above figures that most businesses will not have a standards section nor even a person dedicated solely to the task. It must be assumed that the functions described in this publication, whilst being proven in the larger organizations, will be dismantled into more manageable pieces to be suitable for use by the majority. In small firms, standardization may be directed by an executive such as the general manager or the chief designer, perhaps with an acting part-time standards engineer under his direction. The management of standards is likely to be completely different in a large company employing many thousands of people in several geographically separated units, each of which may be largely autonomous in operation. In such cases, standardization may be controlled by a standards executive responsible to the Board of Directors and supported by standardization activities at each locality. In whatever manner the day-to-day operation is conducted, it is essential that interest in standardization is demonstrated by senior management and not left to function on the initiative of a junior member of the organization. Stability of standardization policies and consistent communication and application is extremely important to reliable and timely implementation.

4.1.4 The nature of the business

The nature of the industry influences the standardization activities. In industries such as agriculture, food, machine tool manufacture, steelmaking or equipment users, the standardization organization may be different from those in commerce or in manufacturing companies specializing in a restricted market or in high-technology areas such as household meters, electrical machines or electronics.

In steelmaking and machine tool manufacture, and particularly the food industry, the formulation of international and national standards has traditionally had a significant effect on the product of the company, and standards engineers may be employed to specialize in that field. The influence of standardization has now also spread to most present-day products; from washing machines to television the effect can be seen in the certification schemes for the components and materials of manufacture and the implications of product liability legislation. Many companies are represented on national and international committees personally by the product engineers or designers. Company standards concentrate on the use of national and international standards by internally standardizing bought-out materials or components, codes of practice for drawing offices, purchasing procedures and stores and control.

4.1.5 Savings and benefits

A major exercise, demanding a significant amount of time and effort, requires an assessment of the costs and savings before embarking, but this is not so practical for minor tasks where such an assessment could cost more than doing the job. In the latter case, justification must be instinctive. The costing should balance the savings and benefits against the total costs. For example, if a printed circuit code of practice is being considered, the total costs in that area should first be established, including space, plant and equipment, labour, maintenance, manufacturing costs, materials and so on. Creating documentation may be considered as part of the production overhead costs, and such costs recovered accordingly. The savings on the supporting services such as design and sales should also be considered, as should other less obvious savings (see figure 4.3).

Recognition of standardization as essential to management control in a company is first acknowledged by the allocation of Boardroom responsibility. This may result in the appointment of a person to take responsibility for standardization in the organization. With so much scope primary objectives should be stated clearly. The nominee should make sure that he understands his priorities. If he is not clear about what is expected of

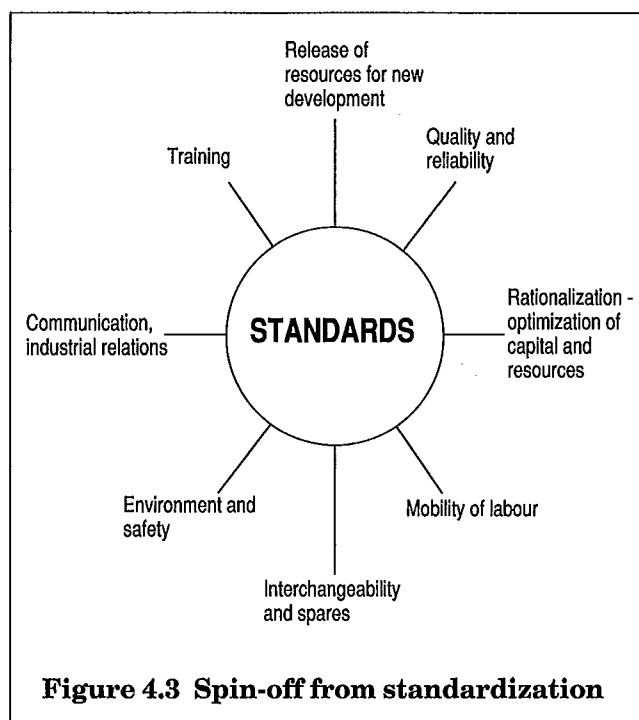


Figure 4.3 Spin-off from standardization

him, he should discuss these objectives with his director and agree terms of reference.

Savings and benefits may be achieved in any of the following areas:

Design:

- (a) clear and unambiguous specification;
- (b) use of a rationalized range of parts and materials;
- (c) consistent design for reliability;
- (d) product quality;
- (e) product safety;
- (f) design for test and inspection.

Materials management:

- (g) improved stock control and lower stock investment;
- (h) improved purchasing efficiency;
- (i) reduction in storekeeping costs;
- (j) improved lead times.

Manufacture:

- (k) reduced manufacturing costs;
- (l) less scrap and waste;
- (m) better regulation and control in manufacture;
- (n) lower training costs;
- (o) mechanization of information handling;
- (p) lower plant or energy costs;
- (q) assistance to successive operations.

Quality and reliability:

- (r) reduction in inspection and testing costs;
- (s) improvement in quality assurance;
- (t) improved reliability;
- (u) reduced spares and maintenance costs.

General:

- (v) improvement of turnover on capital employed;
- (w) reduced documentation costs in design and production;
- (x) improvement in safety and welfare;
- (y) lower overheads;
- (z) saving in floor space;
- (aa) improved communication.

4.1.6 The control of overhead costs

Overhead costs are particularly incurred where there is a shortage of management control, so this is an area in which standardization in the form of codes of practice and material specification can assist by:

- (a) improving communication;
- (b) reduction of material shortages and improved lead times;
- (c) control of consumable materials used in production and maintenance of plant and equipment;
- (d) improved efficiency of design data, reference to standards and provision of technical information;
- (e) rationalization of stores and handling by classification and coding;
- (f) quality control and inspection by reference to standard specifications or codes of practice;
- (g) economical purchasing;
- (h) reduction of training costs and improvement of training and education by documentation in the form of standards;
- (i) proper control of spares.

4.1.7 Viability

Since it is essential that the standardization function remains economically viable, resources should be carefully deployed with regard both to existing and future tasks. The work should reflect the responsibilities of the associated department. For instance, if the standards activity is involved with the drawing office, some of the functions essential to drawing office activity, such as the specification and coding of all bought-out components and materials, should be incorporated. This will ensure the continual employment of

standardization in the department and justify the resources for other specialized activities such as rationalization exercises.

The number of man-hours allocated to standardization and quality control should be related to the demand but there will obviously be an optimum investment in this activity. A standards group, if justified, can employ specialists but it should not over-specialize and should be careful to satisfy the needs of as wide a spectrum as possible. A company standards manager will need to produce standards related to:

- (a) quality systems;
- (b) policy and conformance with European legislation;
- (c) design;
- (d) purchased components;
- (e) raw materials;
- (f) manufactured components and processes;
- (g) assembly methods;
- (h) plant and equipment;
- (i) packaging.

Increases in staff should only be necessary as a result of an increase associated with 'on-line' work or, for example, if allocation of 'part' codes is undertaken and the number of parts to be coded increases beyond the capability of one person to deal with them (though such requirements would surely be contrary to the benefits so will not normally be necessary). It is sometimes possible to combine the responsibilities with quality control, purchasing or design. The use of a word processor is absolutely vital to the modern standards department as much of the work in specification writing is editing. 'Desktop publishing' can also be a considerable advantage in improving presentation. Methods such as these enable the standardizer to work self-sufficiently with a minimum of clerical support.

Like quality assurance schemes, standardization requires vision and investment in order to produce results and it often depends on inspired justification prior to inception. The following checklist may be used as a guide to presenting the justification of expenditure.

- (1) expected benefits;
- (2) estimated data and period of costs;
- (3) estimated life of benefits;
- (4) depreciation of benefits;
- (5) estimated annual cost saving or increased profit;
- (6) estimated total cost saving or increased profit during life;