

Design management systems

Part 2. Guide to managing the design of manufactured products

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- Association of Consulting Engineers
- Association of Project Managers
- BEAMA Ltd.
- British Standards Society
- Chartered Society of Designers
- Defences Manufacturers' Association
- Department of Trade and Industry
- Design Council
- Electricity Association
- Federation of Small Businesses
- GAMBICA (BEAMA Ltd.)
- Health and Safety Executive
- Institute of Quality Assurance
- Institution of Electrical Engineers
- Institution of Civil Engineers
- Institution of Engineering Designers
- Institution of Mechanical Engineers
- Ministry of Defence
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Contents

	Page
Committees responsible	Inside front cover
Foreword	ii
Introduction	1
Guide	
Section 1. General	
1.1 Scope	3
1.2 References	3
1.3 Definitions	3
Section 2. Managing the design of manufactured products at corporate level	
2.1 General	4
2.2 Responsibility for design	4
2.3 Formulation of corporate design philosophy, objectives, strategies and design programmes	4
2.4 Communication of corporate design objectives, strategies, philosophy and programme	6
2.5 Corporate aspects of design management	6
2.6 The totality of products	8
2.7 Corporate design team and alliances	9
2.8 Corporate investment programmes	9
2.9 Auditing and control of corporate design standards, activities and procedures	10
2.10 Evaluation	11
Section 3. Managing the design of manufactured products at project level: overview	
3.1 General	12
3.2 Model for managing the design of manufactured products	12
3.3 Concept phase	12
3.4 Feasibility phase	14
3.5 Implementation phase	16
3.6 Termination phase	17
Section 4. Managing the design of manufactured products in more detail	
4.1 General	18
4.2 Expansion of model for managing the design of manufactured products	18
4.3 Concept phase	19
4.4 Feasibility phase	21
4.5 Implementation phase	22
4.6 Termination phase	26
4.7 Process: Prototypes and articles for test	26
4.8 Design control, verification, review and evaluation	26
4.9 Control and increasing design efficiency	30
4.10 Design support facilities check-list	31
Annex	
A (informative) Bibliography	32
Figures	
1 Sequence of analysis from corporate objectives to corporate design programme	5
2 Model of the design process for manufactured products	13
3 Product design and development cycle showing typical curve of financial commitments	14
4 Factors to be considered when formulating design briefs and product design	15
5 Roles and responsibilities matrix	23
6 Generation of ideas over time during brainstorming sessions	23
7 Design implementation process	27
List of references	34

Foreword

This Part of BS 7000 has been prepared by Technical Committee MS/4. Together with BS 7000 : Part 3 and BS 7000 : Part 4, it replaces BS 7000 : Part 1 : 1989 which is withdrawn.

In October 1993, BS 7000 *Guide to managing product design* was renumbered BS 7000 : Part 1 to accommodate further Parts. It is intended that a completely rewritten BS 7000 : Part 1 will be published in due course as a guide to innovative product design.

The current BS 7000 series of design management standards comprises the following Parts.

Part 2. *Guide to managing the design of manufactured products*

Part 3. *Guide to managing service design*

Part 4. *Guide to managing design in construction*

Part 10. *Glossary of terms used in design management*

Other Parts may be added.

This British standard should not be quoted as if it were a specification and particular care should be taken to ensure that claims of compliance are not misleading. The guidance and recommendations given are intended for general application and may need to be adapted to suit the particular circumstances for which they are being considered.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Introduction

The success of business enterprises is built largely on their products, services and corporate reputations. Design has a critical influence on the conception and delivery of products that closely match the customers' needs and aspirations. It is also instrumental in manifesting the corporate identities of organizations.

Design is recognized as an important element in the differentiation between competing products, and is becoming an imperative to profitable survival in increasingly competitive world markets that demand continuous improvements. Any business discipline that is central to the creation of wealth merits close attention as a strategic resource. Design presents stringent intellectual challenges in business and should be managed rigorously.

The concepts, principles and quality system elements described in this standard are applicable to all forms of manufactured products. Applying the principles described will enable the creation of products that are produced to time and within budget, meet customer and corporate requirements, and have a better chance of competing successfully in world markets.

This Part of BS 7000 sets out the tasks and responsibilities in implementing an effective design policy for the following:

- a) senior management (in section 2);
- b) project managers (in section 3);
- c) design managers and designers (in section 4).

In large organizations, these tasks and responsibilities are usually discharged by different individuals. In small organizations, they may be undertaken by a single person but are, nevertheless, distinct and different. All those involved should be aware of what is required of them. It is therefore recommended that they should understand the full content of this standard while paying particular attention to the section that is most directly relevant to them.

All those concerned with design, in whatever capacity, should always strive to improve the detail of any design work with which they are involved. They should also seek to upgrade the actions, processes, philosophies and disciplines that comprise the core skills for creating products and services through design.

In the context of this Part of BS 7000, the prerequisites for effective design management are the following:

- a) awareness of customers' interests and needs;
- b) commitment to quality and reliability;
- c) genuine and visible commitment to effective design;
- d) motivation of all staff involved;
- e) a vision of the future and clear objectives;
- f) awareness and understanding of organizational capabilities and limitations as well as relevant internal activities and innovations;

- g) awareness of production capabilities and requirements and their consequent effects on design;
- h) provision of adequate resources (personnel, equipment, funding, information and facilities);
- i) provision of organizational systems;
- j) awareness of competitors as well as relevant external activities and innovations;
- k) nurturing an environment that encourages innovation and creativity.

While the design process is described as a series of sequential steps, opportunities for concurrent working should be considered for all functions. This helps to reduce timescales and costs when introducing products.

The following checklists summarize the corporate and project management aspects of product design.

Check-list for senior executives

Design should be handled professionally on a properly planned basis; the following is a summary list of key actions:

- a) reinforce the strategic importance of design by addressing design and design management issues regularly at top executive meetings;
- b) define and periodically update corporate design objectives and strategies that facilitate the fulfilment of corporate objectives;
- c) formulate a corporate design philosophy and promote it enthusiastically;
- d) draw up a corporate design programme; control, review and update it at appropriate intervals to maintain its relevance to the fulfilment of corporate objectives;
- e) ensure that the corporate design programme complements, enhances and is compatible with the other major plans of the organization;
- f) understand the risks, and take steps to mitigate their effects;
- g) determine the returns on investment on all resources committed to design (not just capital);
- h) plan to provide the necessary finance and other resources to enable the corporate design programme to be implemented effectively;
- i) assign design responsibilities to competent and qualified executives, then motivate them to acknowledge these responsibilities and their ability to perform to specification;
- j) communicate corporate design objectives, strategies and programmes to all involved, and ensure that there is a common understanding of their substance and implications;

- k) introduce and reinforce an appropriate design management system and infrastructure to sustain design work to the required standard, ensuring that it is integrated with other disciplines;
- l) monitor and control expenditures against plans and time, and record achievements;
- m) use the most appropriate skills available and bring others up to the required standard of performance through design awareness and training in design management skills;
- n) underpin the importance of design as a strategic resource by maintaining a genuine and visible commitment to it.

Checklist for project managers

The following points summarize the management of design at project level:

- a) the main cause of failure of the design to gain market acceptance is that of not understanding customer requirements, and market research should always be undertaken as part of the design process;
- b) a specific design management model should be used that suits the organization and the product to be designed;
- c) the relatively low cost early stages of the design process are the most appropriate period for change;
- d) areas for concurrent working should be considered at the start of the project and a multi-disciplinary team that includes all relevant specialisms should be assembled;
- e) the design process should be reviewed at regular intervals against the design brief and specifications;
- f) costs should be controlled through continuous review against the budget, using techniques such as earned value analysis;
- g) the configuration of the product should be controlled from the issue of the first drawing through to final disposal (BS ISO 10007 gives guidance on configuration management);
- h) upon completion of the design activity, the project and design management processes and deliverables should be evaluated;
- i) any areas for improvement in management processes or technical performance should be identified during the periodic reviews, audits and final evaluation, and changes made as required for the benefit of future projects;
- j) it is essential that the project manager retains control over the design project at all times.

Section 1. General

1.1 Scope

This Part of BS 7000 gives guidance on managing the design of manufactured products. It is relevant to all types of product that undergo a manufacturing process and for every stage of alteration from raw material through fabrication, delivery and use to ultimate disposal. It also addresses all levels of staff and management, in all types of organizations involved in design.

Products that are subsequently involved with services or construction are within the scope of this Part. Guidance on the management of service design and construction design is given in BS 7000 : Parts 3 and 4 respectively, to which reference should be made.

Guidance is given on the application of general principles and techniques to the management of design. Discussion of the techniques themselves, such as management of people and time, and their application to areas other than design and the design process itself, are excluded.

NOTE 1. Appropriate reference is made to other documents for guidance on general management techniques. A bibliography is included in annex A.

NOTE 2. Guidance on procedures needed to meet statutory requirements, such as health and safety, or product certification and liability, is not intended to be comprehensive. Reference should be made to other documents where appropriate.

NOTE 3. This standard is intended to complement BS EN ISO 9001 : 1994 to which reference should be made.

1.2 References

1.2.1 Normative references

This Part of BS 7000 incorporates, by dated or undated reference, provisions from other publications. These normative references are made at the appropriate places in the text and the cited publications are listed on page 34. For dated references, only the edition cited applies; any subsequent amendments to or revisions of the cited publication apply to this Part of BS 7000 only when incorporated in the reference by amendment or revision. For updated references, the latest edition of the cited publication applies together with any amendments.

1.2.2 Informative references

This Part of BS 7000 refers to other publications that provide information or guidance. Editions of these publications, current at the time of issue of this standard, are listed on page 34, but reference should be made to the latest editions.

1.3 Definitions

For the purposes of this Part of BS 7000, the definitions given in BS 7000 : Part 10 : 1995, BS 3811 : 1993, BS 4778 : Part 3 : 1991, BS 6079 : 1996, BS EN ISO 8402 : 1995 and BS ISO 10007 : 1996 apply.

Section 2. Managing the design of manufactured products at corporate level

2.1 General

This section addresses matters that relate to the management of design from the perspective of the organization as a whole. It focuses on the direction and guidance that all those involved in undertaking or administering design activities should expect from board directors and senior executives. In small organizations, this guidance should come from owner-managers and partners.

NOTE. For the sake of brevity, the term 'senior executives' is used in most instances from 2.3 onwards to denote all these individuals.

Organizations develop their competence in design management in stages. The way senior executives progress through these stages is strongly influenced by their personal interests, the specific circumstances in their organizations and the markets served. The guidance in this Part of BS 7000 provides insights into what should eventually be attained at all levels of an organization.

2.2 Responsibility for design

An organization's standards of design are affected far more by those who manage design than by the specialists who undertake the creative work. Therefore, it is essential that responsibility for design is assigned formally to competent and experienced executives.

Ultimate responsibility for the excellence of designs produced by, or on behalf of, an organization rests with the board of directors, owner-managers or partners. It is the board's collective responsibility to ensure that the organization has an understanding and a clear stance and sense of direction with respect to design so that all contributors and disciplines may be harnessed to their full potential.

It is the chief executive's responsibility to ensure that this direction is followed effectively and that design makes a full contribution to corporate performance.

Chief executives may assign day-to-day executive responsibility for design to other members of the board or executives in the management hierarchy who report directly to them. A chief executive's design committee, or design policy group, may also be established to oversee the management of design and design management issues at corporate level.

Senior executives should demonstrate a clear understanding of their responsibilities for design and a commitment to design excellence through their statements and actions. In particular they should ensure that competent and committed teams are brought together to address design requirements.

Elements that constitute design responsibility should be clearly articulated and communicated to colleagues throughout the organization. Executives and staff should be given guidelines within which to operate. They should know who to turn to for guidance, authorization to proceed with a particular design idea or project, or other design-related decisions.

It is also vital that all executives who have design responsibilities, or otherwise get involved in design activities, should have these responsibilities and activities clearly stated in their job descriptions. These factors should be reviewed periodically.

2.3 Formulation of corporate design philosophy, objectives, strategies and design programmes

2.3.1 General

All design investments and activities should be linked closely with activities in other disciplines: they should not be undertaken in isolation. The achievement of corporate objectives requires resources to be harnessed to their full potential. A carefully crafted statement of an organization's business mission may provide a powerful motivation and sense of direction. Figure 1 outlines the logical iterative analysis that senior executives should undertake, starting with corporate objectives and ending with a corporate design programme.

2.3.2 Corporate objectives, strategies and mission

Corporate objectives should provide the foundation and motivation for all activities, including design. Senior executives should formulate such objectives in a precise and, whenever possible, quantifiable manner. Corporate strategies should be drawn up as prescriptions of approaches to be taken and how resources will be harnessed to achieve the corporate objectives set.

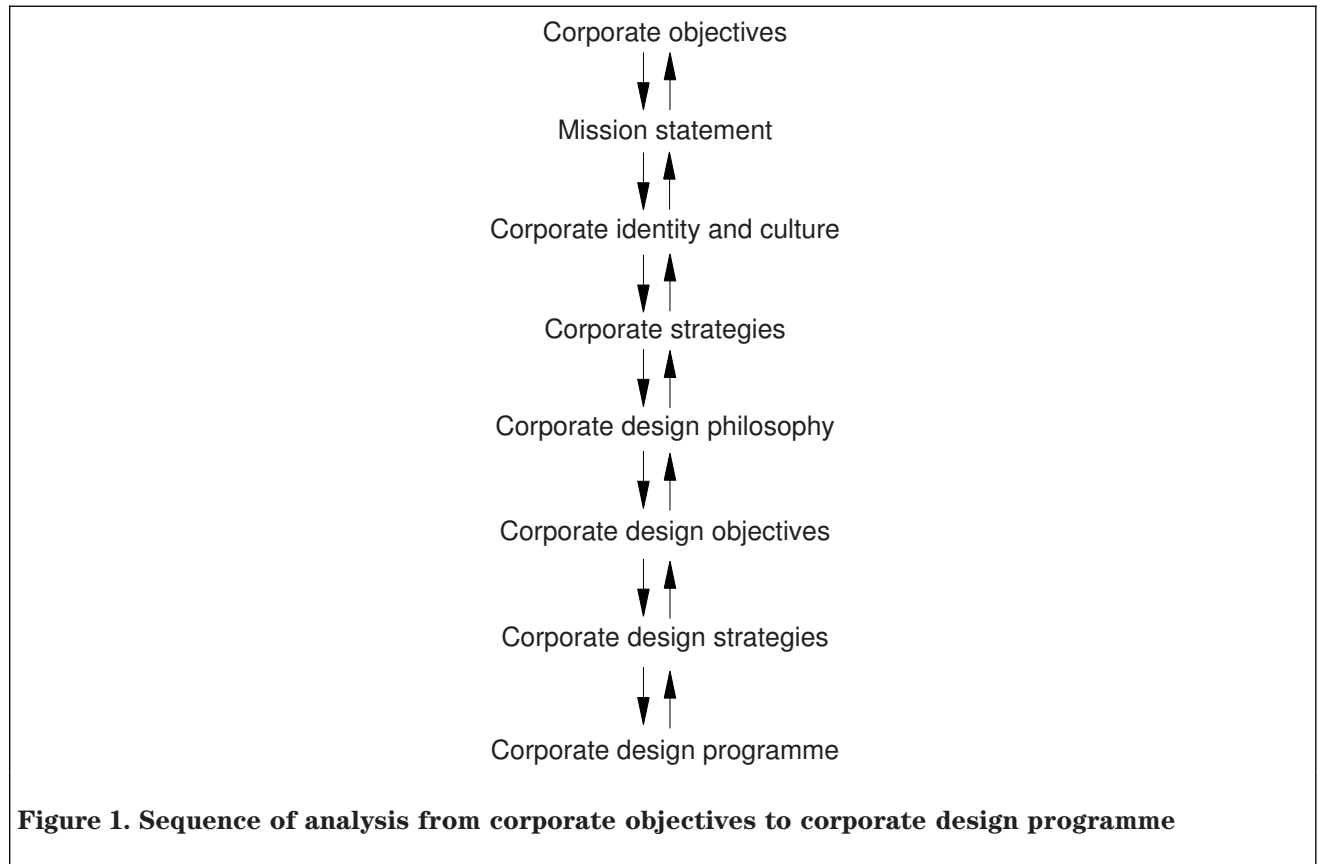
These objectives, strategies and, where appropriate, a statement of business mission, should be documented in a corporate or business plan, and cited in operating and departmental plans.

Senior executives may also wish to publicize and explain objectives and strategies in other corporate communications such as annual reports, briefings to financial institutions, and staff training programmes.

2.3.3 Corporate identity and culture

Those who manage design should take account of the corporate identity and culture of the organization, the physical, operational and human features and values that give the organization its unique personality.

Care should be taken to ensure that the designs of products and associated outputs reflect and enhance the organization's identity, and that design and design management procedures are co-ordinated and in harmony with the prevailing corporate culture.



2.3.4 Corporate design philosophy

Consideration should be given to formulating a statement of corporate design philosophy to complement an organization's business mission. This should explain an organization's general stance towards design, the basic reasons for design discipline and its contribution to corporate performance.

Corporate design philosophy, objectives and strategies together define the boundaries of what is acceptable to the organization in terms of design activities and investments.

2.3.5 Corporate design objectives and strategies

Working from the basis of an organization's overall business objectives, culture and strategies, senior executives should ensure that the design implications are carefully thought through and clearly documented. Corporate design objectives and strategies should be formulated and, wherever possible, quantified.

Senior executives should also nurture a proactive attitude among colleagues: for example, key executives and staff may be invited to put forward suggestions of how design might facilitate the implementation of corporate strategies, and thus the achievement of corporate objectives. Where appropriate, these suggestions should be developed into formal proposals for short- to medium-term design activities and longer-term investments in design that are reviewed before being sanctioned for implementation (see also design brief in 3.4.2 and 4.4.2).

2.3.6 Corporate, business, design and product plans

Design should be considered in all major plans drawn up within business organizations. Senior executives should ensure that all relevant design and design management issues are addressed during the planning cycle, and that the results of deliberations are documented in the corporate or business plan. If a separate section for design cannot be created, these issues should be clearly identified in other sections.

Corporate and business plans should address the manner in which market demand and technological advances will be brought together in the range of products and services offered by the organization.

Industries, markets and specific niches upon which particular attention and resources need to be concentrated should be highlighted.

The emergence of new markets and forecasts of potential demand should be complemented by assessments of positions of current products and services in their life-cycle, and thus future turnover and profits. This analysis may reveal potential gaps in corporate performance.

Design strengths and weaknesses, opportunities and threats should be highlighted and investigated.

This information may be expanded into a separate document that focuses specifically on the organization's current and planned range of products and services.

2.3.7 Corporate design programme

All approved proposals for investments in design should be co-ordinated within a corporate design programme. This programme should set out specific activities in all categories of design to be undertaken, the outcomes sought as well as its contribution to the attainment of corporate objectives.

The programme should summarize design briefs and specifications, with the planned work broken down into stages. Skills and other resources to be committed and outputs to be generated at each stage should be specified, together with associated timescales.

It is important that this programme can be referred to and controlled by those involved and interested in design in a formal, easily accessible working document.

2.4 Communication of corporate design objectives, strategies, philosophy and programme

The value of plans will be enhanced if they are documented and communicated effectively. Executives and staff need to be fully aware of the direction and objectives set so that they work in unison, yet most organizations restrict the circulation of plans to key executives. Considerable benefits may be derived from informing virtually all staff of the essential features of plans through team briefings, staff conferences and newsletters.

It is also important that stakeholders outside an organization are kept appropriately informed of its overall intentions and strategies. This will give reassurance that proper preparations have been made to ensure future prosperity, and that there is the leadership and clear sense of direction to turn those intentions into reality.

Corporate and business plans tend to be long and complex documents: dense text and large amounts of figure-work can make them difficult to assimilate. Staff often get the impression that implementation is the job of colleagues elsewhere and has nothing to do with them. This misconception is dangerous. All staff should be made aware of their individual responsibility for the successful implementation of plans and efforts should be made to issue a summary reference that helps to motivate staff and builds team spirit.

Design, as a discipline, may do much to bring to life textual and quantitative information, to provide fresh perspectives and vivid presentation using stimulating and easily comprehensible visual imagery.

2.5 Corporate aspects of design management

2.5.1 Design management infrastructure

To manage design rigorously requires an infrastructure of procedures and standards to be in place which goes beyond the personal interests and approaches of individuals in charge. Therefore, an effective system for managing design should be formally adopted and linked in with the management systems of other business disciplines.

It is a key responsibility of senior executives to create such a 'living' system and promote it to the point where it is fully implemented, operating smoothly, openly appreciated and firmly embedded within the organization.

Design management systems at the corporate level should be concerned with the following key issues:

- a) design responsibility and leadership;
- b) the positioning, visibility and integration of design;
- c) corporate design philosophy and strategy formulation;
- d) auditing corporate design and design management practices;
- e) the degree of centralization in managing design;
- f) establishing and maintaining corporate design standards and guidelines;
- g) the environmental dimension of design;
- h) the legal dimension of design;
- i) the establishment and nurturing of a corporate design team;
- j) design awareness and design management skills development programmes;
- k) the harnessing of appropriate technologies;
- l) the assessment of opportunities and risks attached to investments in design (see also 4.6.3 of BS 6079 : 1996);
- m) the funding of design activities;
- n) design and the manifestation of corporate identity;
- o) the evaluation of the contribution of design to corporate performance.

2.5.2 Links with other disciplines

Given the strategic significance of design in the development of new products and services, it is essential that it should be positioned at the forefront of business activity. Using design as a tactical tool on an ad hoc basis, after all major decisions have been taken, severely limits its contribution, and places organizations at a competitive disadvantage. Severe difficulties might also arise when there is insufficient time to address the implications of such late design decisions, as, for example, when new technologies and manufacturing processes are to be adopted.

Design is inherently an integrated and integrating discipline. Harnessing its full potential requires close links with all disciplines. It is essential that senior executives promote such links, dismantle functional barriers and encourage true inter-disciplinary team work.

2.5.3 Corporate design standards

All organizations operate to standards, the majority of which are imposed from outside by factors such as legislation, customer demand, professional regulation and competitive action.

Senior executives should ensure that all such standards are complied with and, wherever appropriate, exceeded to achieve competitive advantage (see also 2.5.6).

2.5.4 Visual identity of products

Senior executives should decide whether products are to be co-ordinated visually. That key decision may be influenced by factors such as the following:

- a) the strength of an organization's corporate and visual identities;
- b) the split of product ranges into brands with distinct identities;
- c) the commercial benefits of being clearly differentiated from the competition in terms of consumer preference, greater market recognition and loyalty, and opportunities for cross-selling;
- d) the additional costs imposed by being distinctive and sustaining that distinction;
- e) the cost savings to be made by rationalization and adopting modularity of product configurations;
- f) the cost savings to be made through consistency of presentation.

Visual identity is conveyed on products by:

- 1) colours;
- 2) materials;
- 3) textures;
- 4) shapes and styling of casings, disposition of controls and components;
- 5) graphic identification through use of company logotypes, symbols and typefaces;
- 6) presentation of information and instructions on casings and visual displays;
- 7) packaging and user manuals.

2.5.5 Environmental dimension of design

Environmental factors influence purchase decisions, and many consumers appreciate buying from organizations known to be responsible members of the community, especially in their attitude towards the environment.

Consequently, organizations might adopt a 'cradle to grave' approach to monitor practices, performance and impact from source of raw materials through to final disposal and recycling of products. They should continuously address environmental issues relating to product design and development to achieve the following:

- a) a reduction in consumption of energy in their manufacturing processes;
- b) a reduction in their products' consumption of energy during use;
- c) a reduction of material waste (for example, during manufacture and in packaging);
- d) a reduction or elimination of adverse impacts on the environment through emissions and discharge of waste;
- e) the simplification or optimization of fabrication and assembly procedures (for example, by reducing unnecessary variety in materials and components used);
- f) improvements in the performance of bought-in materials, components and equipment, as well as in the practices of suppliers;
- g) the identification of uses for the by-products of the manufacturing process;
- h) the introduction of recycling of materials and spent components;
- i) the continuity of a product range allowing compatibility when upgrading without the need to replace;
- j) the extension of the durability and life of products by designing for refurbishment and designing-out unnecessary obsolescence;
- k) increases in the efficiency of distribution by reducing size, and improving stackability and storage;
- l) the containment or reduction of costs (including those for disposal of used or obsolete products).

NOTE. Reference should be made to the Environmental Protection Act, 1990 [1] and BS EN ISO 14001 for more detailed guidance on environmental requirements.

2.5.6 Legal dimension of design management

The legal dimension of product design is of crucial importance, due to the potential for litigation in the civil courts in respect of allegations made against products and associated manufacturing processes. It is also essential to protect the organization's intellectual property rights.

Copying innovations has become an easier and more rapid process. Counterfeiting and infringement of intellectual property rights is also more frequent and widespread. Consequently, there is a need for considerable care and vigilance to ensure that an organization complies with local requirements wherever it operates, and profits as long as possible from its intellectual assets.

There should also be formal procedures in place to:

- a) maintain records of key decisions, actions and changes that affect the product design, (for use, among other things, as potential evidence in case of disputes and litigation);
- b) check that similar designs, patents, trade marks and service marks have not already been registered;
- c) register designs, patents, trade marks and service marks;
- d) ensure that the design is documented and controlled from the start of the project (see also BS ISO 10007);
- e) ensure that potential customers and suppliers sign non-disclosure agreements before being supplied with commercially sensitive design information;
- f) detect counterfeiting and other infringements quickly, and take strong action to stop them;
- g) deal with product failures and customer complaints;
- h) recall products from the market whenever necessary;
- i) check compliance with all standards, testing procedures, health and safety at work requirements, and requirements concerning the disposal of packaging and products after use;
- j) keep track of new legislation in all countries where the organization has interests;
- k) make appropriate representations to influence the debate about proposed new directives, regulations or laws;
- l) ensure that the organization is prepared well in advance to comply with new legislation;
- m) use recyclable materials and reusable or refurbishable components wherever possible.

NOTE. The Construction (Design and Management) Regulations : 1994 [2] require the client to appoint a planning supervisor. These regulations place statutory duties on clients, designers and constructors to plan, coordinate and manage health and safety aspects throughout all stages of construction projects (see also BS 7000 : Part 4).

2.6 The totality of products

2.6.1 General

Customers' satisfaction arises out of their overall experiences with products and associated services, and this requires careful attention to elements of the total offering that contribute to these experiences. Senior executives should ensure that all these elements are identified and defined, understood and familiar among staff. They should also endeavour to position their products and services competitively.

2.6.2 Researching customer attitudes and needs

Research into customer and user attitudes and aspirations, work and life-style is essential. Particularly instructive is observation of how users interact with products from the moment that they first perceive a product (or perhaps take it out of its pack) to final disposal. Ergonomic factors such as simplicity of design, user-friendly interface and ease of use by the infirm and disabled should be considered.

Care should be taken to establish whether expressed needs or other factors are those that most influence purchase decisions, especially as these may vary between first and subsequent purchases. All these may suggest opportunities for new products, improvements to existing products and different ways to present products to the market.

Among the most powerful sources of ideas for new or improved products is the understanding of the following:

- a) customer perceptions (especially of their needs and wants);
- b) what triggers purchase decisions;
- c) how decisions to purchase are reached; and
- d) how customers use products and services.

Keeping close to customers and markets in this way is critical to success. Senior executives can do much to raise performance by insisting that such marketing and design research is undertaken continuously and that findings are acted on without undue delay.

Perhaps the most powerful way of achieving such closeness is to establish strategic partnerships with key customers, distributors and suppliers.

2.6.3 Product launch and presentation

Creating a new product or improving a current product is only part of the overall project, often a relatively easy part. Success also depends upon an effective launch and support in the market throughout the life of the product.

Senior executives should ensure that the launch of new products, and re-launch of improved products, are taken seriously by all involved, and someone should be appointed early on in design and development projects to oversee this critical stage.

The project budget should make adequate provision for funding product launches. Commitments should also be obtained from those having responsibility for launch activities, especially where launches are planned in several countries around the world involving subsidiaries, partners, agents, licensees and other interested parties.

2.6.4 Product promotion, distribution and customer support

Customers' overall experiences with products include the following elements:

- a) advertising;
- b) promotional literature;
- c) packaging;
- d) user instructions;
- e) presentations and displays in stores;
- f) showroom environments;
- g) the appearance, courtesy and knowledge of sales staff;