# 1 INTRODUCTION

## 1.1 Overview

International trends are demonstrating that concepts and tools such as design for environment (DfE), life-cycle assessment (LCA) and extended producer responsibility (EPR) are here to stay. They are rapidly becoming key tools for forward-thinking corporations. Furthermore, a growing body of evidence suggests that such approaches are exceptionally well placed to deliver a range of benefits over and above environmental benefits and mere compliance. These 'new millennium' tools will revolutionise how business creates new products and services and how consumers and government will compare, assess, regulate and purchase everyday goods.

In particular, DfE provides a unique opportunity to make critical interventions early in the product development process and eliminate, avoid or reduce downstream environmental impacts. What will emerge as a continuing thread throughout this book is that DfE is a technical and creative 'key'—a device that can substantially determine how a product is likely to interact with the environment and its users. In other words, DfE can make considerable environmental and commercial gains based on the basic philosophy that 'prevention is better than cure'.

### *1.1.1 Environmental improvement: why focus on design?*

Environmental impacts occur at all stages of a product's life-cycle. Different types of products have impacts at different stages of the life-cycle. For example, for furniture the raw materials and final disposal embody most of the environmental impacts, and for energy-consuming products such as household appliances the use of the product embodies most of the environmental impact. However, no matter where in the product life-cycle the impact lies, most of the impact is 'locked' into the product at the design stage when materials are selected and product performance is largely determined. This concept is represented in Figure 1.1, along with the types of strategy used to address environmental performance along a product development cycle.

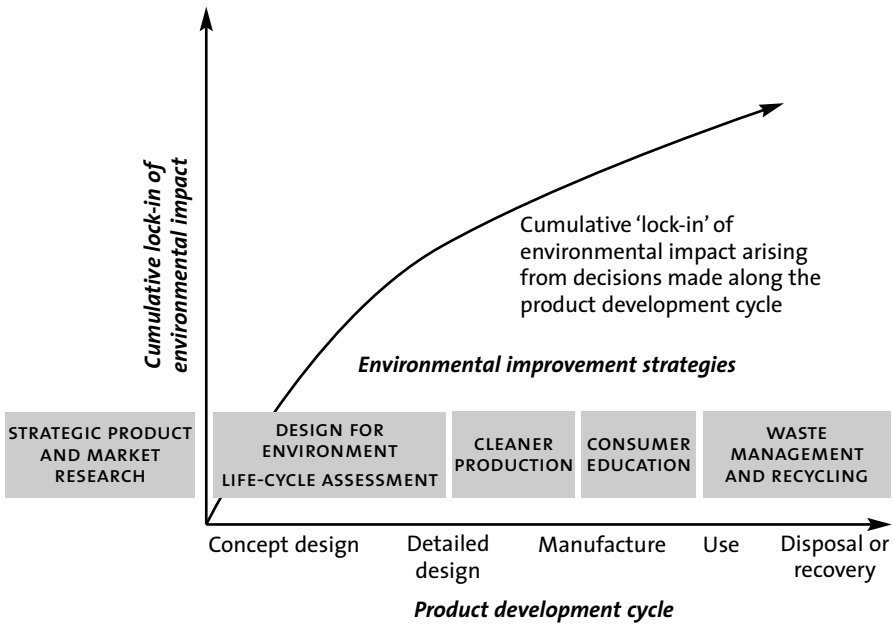


*Figure* 1.1 **Conceptual representation of environmental 'lock-in' over a product's development cycle**

At a very practical level, DfE, accompanied by a judicious use of LCA, provides one of the most powerful tools in pursuit of sustainable products. It is at the product planning and design stage that waste avoidance, source reduction, water conservation and energy efficiency can be locked into products, services and buildings. Trying to implement such strategies once the design is resolved or settled generally reflects an 'end-of-pipe' orientation and represents 'yesterday's thinking'.

What becomes apparent—whether one is considering a domestic appliance, food packaging, office furniture or textiles—is that only a life-cycle design approach can lock in positive environmental features and lock out undesirable environmental impacts. At a policy level, it is a genuine product stewardship approach that embodies the principles of EPR, with brand-owners taking much greater responsibility for their products when they are discarded.

The overarching significance of DfE is further reinforced by the expanding list of companies allocating substantial resources to sustainable product development. Their creation of environmentally improved products is not only testament to serious corporate environmental foresight but also an acute reminder that the sceptics have got it wrong. Regardless of the goods produced, DfE is becoming a key strategy motivating many of today's companies, including Philips Electronics, Hewlett-Packard, Interface, Wilkhahn, Herman Miller, Miele, Electrolux, Xerox, BMW and Daimler-Benz—to name but a few.

On the subject of companies, methods and sustainability in isolation of people can only go so far. Good design, sustainable design, commercially successful design requires smart thinkers, enthusiastic individuals, committed teams and progressive executives (i.e. innovative eco-product developers).

## 1.2 Critical players: the role of designers and product developers

It becomes vividly apparent that those professions and trades involved in designing new products are key players in helping realise a more sustainable future. Whether it is the formally trained industrial designer, engineer, model-maker, marketing manager, psychologist, technical writer, toolmaker or plastics specialist—we need to recognise that many areas of knowledge work together and toward the development of environmentally preferable products. In many ways it is more accurate to talk about eco-product developers rather than of ecodesigners.

Working alone, the designer's environmental role is limited; in combination with other disciplines, the designer emerges as a critical player in ensuring that a diverse and sometimes conflicting range of issues and considerations are successfully built into a product. It is ultimately the designer who creates the interface between the consumer and the technology underlying the shell or surface of a manufactured product. Thus the designer's ability to play the role of environmental champion is unequalled compared with others.

An interdisciplinary approach is not only an essential requirement of successful DfE but also a highly desirable approach if we want to maximise the commercial and environmental performance of a manufactured product. Collaboration facilitated by a genuine enthusiasm to learn, share, evolve, explore, innovate, discover and apply environmental qualities is likely to result in the rethinking and reconfiguring of the product development process on all fronts, not just the environmental front.

We simply need to look around us, wherever we are, and note the almost infinite extent to which designers shape our physical and virtual worlds. It is ultimately the designer who gives form and meaning to objects that not only offer utility, function and convenience but also entertainment, desire and visual pleasure. However, although a growing number of designers are openly acknowledging that they wish to be part of the solution that is sustainable development, many designers and others involved in product development seem to feel paralysed or restrained from having a positive or significant environmental effect on the design process.

Recognising that the designer or the product development team can take practical action to shape, fashion and model ideas and concepts into sustainable products, it must also be acknowledged that the goal is not to transform designers

into environmental scientists. It is about blending environmental considerations into the roles of all in the product development team—be they designers, engineers, psychologists, marketers, toolmakers or executives. Above all, designers and product developers need to throw off their shackles and forge ahead on implementing DfE. They must start small, make no-risk or low-risk decisions, establish 'environmental' dialogue with suppliers and other stakeholders and, most of all, remember there are probably many common-sense design decisions that they have already been making that equate with DfE. Although some academics emphasise complex methodologies that may blur and burden DfE, the reality is that many significant environmental improvements can be realised through the use of basic checklists and general rules of thumb.

In other words, you do not need to be a rocket scientist to successfully implement DfE strategies within a commercial context. Understanding the jargon and terminology may help, though.

## 1.3 What's in a name? Some definitions

Accurate descriptors or buzzwords? What is design for environment and where does it sit on the spectrum of other terms related to environmentally oriented product design? Is it different from green design, ecodesign and sustainable design?

The answer to these questions depends on who you ask; however, the ultimate goal or end-point associated with such terms remains similar: that is, designing products as though the environment matters, and minimising their direct and indirect environmental impacts at every possible opportunity.

In essence, whether the process is referred to as DfE or ecodesign, the fundamental objective is to design products with the environment in mind and to assume some responsibility for the product's environmental consequences as they relate to specific decisions and actions executed during the design process. Obviously, the designer cannot bear responsibility for all negative effects; however, the designer *can* have a significant influence over the environmental impacts that may arise upstream and downstream of his or her own interaction.

A robust DfE approach is one that blends creative excellence, innovation and technical rigour with a view to fearlessly pursuing major environmental and functional objectives. Ultimately, products have a function and a purpose, and this must remain the designer's priority. The challenge is to assert product functionality while simultaneously minimising life-cycle environmental impacts and maximising competitiveness.

One of the critical adjuncts to DfE over the past decade has been incorporation of LCA, sometimes more popularly referred to as cradle-to-grave analysis. LCA is one of the most useful tools in identifying and assessing the environmental aspects and potential impacts associated with a product. The value of LCA is in

its ability to map a product's environmental impact across its whole life-cycle, including:

- Extraction and processing of raw materials
- Manufacture of the product (and any associated packaging and consumables)
- Use or operation of product
- End-of-life options (e.g. re-use, remanufacture, recycling, treatment and disposal)

A critical distribution or transport phase usually occurs between all the above stages and can have a significant impact on a product's life-cycle environmental impacts.

It is this life-cycle perspective that has formed the cornerstone of DfE and won the support and acknowledgement of progressive governments and corporations, of the global environment movement and of an ever-growing list of influential designers. In design terms, LCA can perform practical functions as well as more strategic tasks.

Use of LCA as a DfE tool can:

- Benchmark the environmental performance of existing products
- Develop environmental targets for the product development team to pursue
- Provide a 'work-in-progress' assessment tool to review how a concept or detailed design might perform environmentally
- Help the product development team make decisions regarding materials and components
- Identify previously unknown impacts associated with a product and associated consumables

The collective outcome of using LCA to provide the above data can inform and direct the design process like no other environmental management tool. Despite its practical value and unique product profiling qualities, LCA does have its limitations and constraints. Poor quality of input data, questionable assumptions, sloppy methodologies and debatable interpretation can all undermine or 'contaminate' LCA. However, when ethically and rigorously utilised, it can significantly enhance the potency of DfE. For more detail on specific LCA strategies and tools, see Chapter 3.

When defined and applied strictly, approaches such as sustainable design or sustainable product development begin to deviate from the way most designers perceive and apply DfE. Sustainable design begins to address the bigger picture by considering collectively some of the harder questions, such as need, equity, ethics, social impact and total resource efficiency and thus the role of design in achieving inter-generational equity. More specifically, sustainable design seeks to

translate and embody global and regional socio-environmental concerns into products and services at the local level. This necessarily demands a systems view of design and does not always focus on realising physical products.

Buzzwords often associated with sustainable design include dematerialisation, product-to-service strategies, 'Factor 4' and 'Factor 20' goals as well as backcasting and other modelling tools (see also Box 1.1). The aim is to minimise incremental 'tinkering' through end-of-pipe environmental management, cleaner production and DfE, and to maximise robust system-wide solutions in pursuit of more sustainable modes of production and consumption. This is discussed further in Chapter 10.

When a designer is immersed in the design process, trying to meet a client's expectations and to satisfy consumer desires, terminology can become peripheral. What is obvious and central to the task is that DfE is an approach concerned with delivering meaningful environmental benefits, possible only through mainstreaming environmental concerns and realising low-impact products that are culturally relevant, economically viable, technically innovative and ecologically compatible.

**THE FOLLOWING IS A PALETTE OF TERMS THAT IN SOME WAY DEFINE OR REFER TO** environmentally sensitive product design.

- Design for environment
- Ecological design
- Environmental design
- Environmentally oriented design
- Ecologically oriented design
- Environmentally responsible design
- Socially responsible design
- Sustainable product design
- Sustainable product development
- Green design
- Life-cycle design
- Dematerialisation
- Eco-efficiency
- Biodesign

No doubt the list will grow as the area develops.

*Box* 1.1 **A palette of buzzwords**

## 1.4 Origins and evolution: an historical snapshot

The origins of DfE as we understand it today probably lie somewhere between the incisive critique of Victor Papanek and the maturing attitudes and actions of industry. Few would argue against Papanek's watershed contribution to the debate surrounding designers and their obligations to society and the environment. Although other writers argued the case against rampant consumerism, maverick manufacturers, poor architecture and life-threatening products (see e.g. Buckminster Fuller, cited in Pawley 1990; Nader 1965; Neutra 1954; Packard 1956), it was Papanek who focused the ethical blowtorch on the industrial design profession.

Papanek's landmark text—*Design for the Real World: Human Ecology and Social Change* (1971)—was one of the more critical contributions towards raising the profile of designers' less successful projects and behaviour. His critique of the design professions, their clients in industry and the associated educational institutions was scathing but accurate. The core of his argument was that designers focused far too much effort on the aesthetic and stylistic aspects of design rather than considering the whole product—its function, utility, reparability, affordability and its environmental and social consequences.

Papanek's sequel—*The Green Imperative: Ecology and Ethics in Design and Architecture* (1995)—was in many respects an updating of *Design for the Real World*, with an emphasis on the ecological rather than the social aspects.[1] He also reported on the progress of industry and designers by presenting case studies on how DfE has been embodied in products and buildings in more recent years.

Nigel Whitely, in his book *Design for Society* (1993), has continued the Papanek tradition of questioning and critiquing the role of designers in an increasingly consumerist society.[2] Not unlike Papanek in his sequel, Whitely seeks to highlight how design can play a more humane and socially relevant role in meeting the needs of everyday living, be it in the first or the third world.

The problem with both texts is their righteous approach to determining what constitutes good design, bad design, green design and so on. Indeed, some of their propositions, arguments, observations and conclusions are not only religious in their zeal but also consistently fail to account for the extent of DfE activity currently under way in industry, facilitated by governments and acted on by designers.

1 Victor Papanek, one of the most eminent working and teaching designers of our time, believes passionately in the power of design to influence our lives and the environment for good or ill. In this inspiring yet practical book he shows how everyone—from those at the forefront of design to the consumers, the end-users, can contribute to the wellbeing of people and planet through a new awareness of design and technology.

2 This is an anti-consumerist-design book in that it exposes what most people would agree are the socially and ecologically unsound values on which consumerist design is constructed. Whitely reviews the implications of ecodesign as part of the movement for a more self-aware and just development of design.

Some of the most exciting developments in recent years have been the emergence of non-conforming designer-based groups that have been proactive in raising the profile of DfE in more general terms. Movements such as O2 continue to expand their programmes of advocacy, promotions, events and lectures. Danish designer Nils Peter Flint gave birth to O2 Denmark, but the O2 Global Network now covers numerous countries around the world. The most refreshing aspect of the O2 groups is its positive and constructive orientation towards DfE. This is further enhanced by the different focus of each group. Whereas some are geared towards running lectures, conferences and publishing newsletters, others operate on a more commercial consulting basis. The O2 Global Network website is definitely worth visiting, at www.O2.org.

As with any special-interest groups, some survive, others perform a function and disappear and yet others expire owing to lack of commitment. The same can be said for DfE-related groups.

Universities and government-funded research institutions have also been pivotal in developing DfE tools, methods and resources. Often located within schools and faculties of engineering and industrial design, the academic research community has made and continues to make a significant contribution towards the evolution and adoption of DfE.

Many of the pioneering universities and research institutions that have forged the DfE path are European and reflect a very strong commitment to environmental protection, investment in research and development (R&D) and a robust design literacy. In particular, the Technical Universities of Delft (TU Delft), Denmark and Berlin[3] have well-established reputations in DfE and in associated areas such as LCA and cleaner production, not to mention strong industrial design engineering programmes. In addition to the TU Delft, another Dutch research organisation—Netherlands Organisation for Applied Scientific Research (TNO)—has been at the epicentre of European and indeed global DfE activity. Together, these two organisations have been, and continue to be, in the vanguard of environmentally oriented product design, successfully executing national demonstration projects such as EcoDesign 1, 2 and 3, including *EcoDesign: A Promising Approach to Sustainable Production and Consumption*, published by the United Nations Environment Programme (UNEP), TU Delft and the Rathenau Institute.

British activity continues to expand through the proactive and dynamic efforts of the Centre for Sustainable Design, based at the Surrey Institute of Art and Design. Numerous other universities across the United Kingdom are focusing on a diverse range of DfE topics and themes. These include Cranfield, Surrey, Brunel and Manchester Metropolitan Universities, all of which are developing new DfE tools that address the needs of key industry sectors, such as electronics, appliances, packaging and commercial furniture.

In Australia, the National Centre for Design at the Royal Melbourne Institute of Technology (RMIT) has conducted some ground-breaking work with manufac-

3 Technische Hogeschool te Delft, Delft, the Netherlands; Danmarks Tekniske Højskole, Copenhagen, Denmark; Technische Universität Berlin, Berlin, Germany.

turing companies through its ongoing national demonstration programme—EcoReDesign™. Whereas RMIT has established a strong reputation for hands-on, commercially relevant DfE processes, Sydney's EcoDesign Foundation has carved out a small niche in New South Wales by undertaking more theoretical explorations, primarily in the architectural area.


*Plate* 1.1 **This eco-packaging concept, designed for Blackmores, Australia, includes a re-usable tub and a lightweight refill pack. It was developed through the EcoReDesign™ programme.**

Photo courtesy Centre for Design at RMIT

The extent of activity in the USA is substantial, but not so tightly focused on universities. Although there are several active and productive research institutions, many innovative DfE initiatives have their origins directly in industry. Mindful of export markets, greener institutional customers and growing pressure from the environment movement and other consumer-oriented non-governmental organisations (NGOs), several US-based corporations have played a key role in advancing DfE. By moving beyond concepts and prototypes in some key product categories, US manufacturers have realised some significant gains. Their ability to deliver intense and strong environmental marketing messages has been even more significant. In the electronic office equipment area, companies such as Xerox, Hewlett-Packard, AT&T and IBM have developed a global reputation for attention to DfE, remanufacturing and product stewardship. High-profile office-furniture manufacturers such as Herman Miller, Steelcase and Knoll have also been long-term players in the research, design, manufacture and remanufacture of ergonomic seating, partitions and workstations. Other US corporations with more diverse activities, such as 3M, have and continue to set new and innovative standards when it comes to DfE and positive environmental qualities in products. The Rocky Mountain Institute (Billings, MT) has also promoted innovative research and policy initiatives, particularly in the field of energy conservation.

The overall rate of DfE development has been very much accelerated as a result of the projects and programmes of DfE commentators, nonconformist design groups and universities. However, one of the main drivers behind more serious attention to DfE has been national governments (especially those in northern and western Europe)—there is nothing like the threat of regulation to get industry rethinking its approach to business!

## 1.5 Big sticks and carrots: the role of government regulation

It is difficult to talk about DfE without noting the significant (and positive) influence that has been exerted by some governments, especially in the Netherlands, Germany and Scandinavia. These countries have been vital in helping facilitate more intense and productive DfE activity in industry. The Dutch and German governments, in particular, have navigated new territory when it comes to the use of new methods and tools to underpin government policy and regulations aimed at improving the environmental performance of industry and its products.

The existence or threat of environmental regulation has had, and continues to have, a considerable influence over some of the larger companies operating in Europe. The regulatory push emanating from Europe is also having a demonstrable effect on product design in the USA, as companies eager to export to Europe and compete with European businesses build in DfE features.

Whether it is aimed at minimising greenhouse gas emissions, increasing energy and water efficiency, developing renewable energy, waste avoidance, resource recovery or eco-labelling, the role of public policy should not be underestimated. Without government intervention, or the threat thereof, it is unlikely that DfE would have come as far as it has. But some governments have been sensitive to provide a careful mix of rewards and incentives as well as stringent environmental laws and targets. The Dutch government, through its Ecodesign initiatives, has mastered the art of demonstration programmes, partly as a way of helping industry prepare for the inevitable tightening of environmental regulations. This balance generates a productive tension between government and business, the government being seen to both regulate and support business.

### *1.5.1 Demonstration programmes*

Demonstrating how the design process can integrate environmental factors within a commercial context is a critical step towards reconfiguring the psyche of product designers, engineers, companies, educators and students. It can also directly articulate that DfE does not have to result in inferior, odd or undesirable products plagued by clichéd colours, textures and forms.

Internationally, the demonstration, or 'do, show and tell', approach to DfE has helped to shorten and steepen the learning curve for designers and the companies who rely on them. With support from governments, research institutions and industry associations, countries such as the Netherlands, Norway, Denmark and the United Kingdom have aimed to encourage greater enthusiasm and on-the-ground action ahead of the policy and regulatory change that would otherwise leave industry floundering in search of innovative solutions to serious environmental concerns.

The essential objective of these demonstration programmes is to assist individual companies with the know-how required to design greener products with reduced life-cycle environmental impacts. Ensuring that the products move beyond slick renderings and glossy models is paramount, as is the need to blend a stronger design and environmental philosophy into company culture, especially that of senior management. Documenting the entire process and generating information materials for dissemination to the broader design community directly fulfils the demonstration objective. 'How to' manuals, design guides, videos and computer software collectively provide first-hand knowledge, methods and guidelines based on specific product case studies and real-life commercial experiences.

### *1.5.2 Defining extended producer responsibility*

By far one of the most influential areas of government environment policy has been the development and gradual implementation of extended producer responsibility (EPR). In a great number of countries, manufacturers face a very different regulatory environment to that (currently) existing in Australia. As levels of concern over issues of pollution and waste disposal have risen, governments have been forced to act to improve the effectiveness of environmental controls and standards. Government action is most obvious and most 'advanced' in Europe, although many of the European approaches have some counterpart in the USA, Canada, Japan, Korea and Taiwan (for a recent overview of the situation in Japan Korea and Taiwan, see Kuraska 1995: 95-109). In these countries, as a response to government action, there is a clear change in orientation on the part of industry. Strategic planning by leading companies, investment in new technology and production processes, the reorientation of business practice and R&D spending all suggest a broad level of acceptance that issues of waste and pollution are of such significance that major structural change to current industrial production is inevitable.

Environmental regulations cover a range of targets and address a number of issues. Some are focused on eliminating harmful substances or practices: restricting the levels of emission of pollutants; banning the use of certain materials (such as ozone-depleting substances); protecting sensitive environments or habitats; prohibiting the transport of toxic substances; and so on. Other regulations aim at altering the economic or social framework so that harmful activities are discouraged while better practice—or improved practice—is encouraged.

EPR and product stewardship are two names for a principle increasingly being adopted around the world as a basis for government policy and programmes to reduce waste and environmental impacts from the end-of-life disposal of goods. The Organisation for Economic Co-operation and Development (OECD 1997) defines EPR as:

> The principle that manufacturers and importers of products should bear a significant degree of responsibility for the environmental impacts of their products throughout the product life-cycle, including impacts [from] . . . the selection of materials, the . . . production process, and . . . from the use and disposal of the products.

In OECD (1996) terms, the objective of EPR is to 'promote the conservation of resources, reduce the use and generation of toxic and hazardous materials and energy, and reduce the quantity of wastes for final disposal'.

EPR is a logical extension of the 'polluter-pays' principle. It rests on an argument that the environmental impacts of resource depletion, waste and pollution are a function of the system of production and consumption of goods and services. Those impacts are substantially determined at the point of production, which is when key choices are made—on materials, on processing and finishing technology, on product function and durability, on systems of distribution and marketing and so on. If that system is to evolve in a way that reduces environmental impacts, then there is a need for policies that create appropriate feedback mechanisms for producers that will direct producers' investment towards continuous environmental improvement. In many OECD and other countries EPR is considered an effective policy mechanism to promote the integration of the life-cycle environmental costs associated with products into the market price for the product.

Stimulating industry to accept responsibility for its products at the end of their life is an important focus for environmental and industrial policy in Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Norway, Sweden, Switzerland and the United Kingdom.[4] It also applies in Japan, Taiwan, Canada and in some US states.

### *1.5.3 The growing interest in extended producer responsibility*

EPR is not a static concept, and the ways in which it is most effectively implemented are still being explored. Internationally, governments (and industry) are paying more attention to the relationship between regulations and innovation and the emergence of new competitive industries. Various approaches to EPR policy are being watched specifically because they appear to stimulate new innovation and business success as well as reduce overall life-cycle environmental impacts.

Many European policy-makers now refer to EPR as the product of a general evolution in approaches to dealing with pollution, waste and other environmental

4 The Environment Act containing the sections giving the UK government power to require producer responsibility for industry in relation to packaging and products was passed in July 1995.

issues. Concern over pollution and waste initially led to end-of-pipe approaches aimed at 'blocking' pollution (with targets and controls on factory emissions, higher costs for waste disposal, etc.). This has generated significant new markets in environmental technologies designed for 'cleaning up' waste (e.g. scrubbing, extracting, filtering) and monitoring waste levels.

This end-of-pipe approach was soon complemented by a more sophisticated interest in waste prevention and pollution minimisation. Internationally, this latter approach became known as 'cleaner production'. From this perspective, factories are no longer treated as discrete entities, the waste from which must be prevented from entering our air, water and land. The interest has shifted to redesigning or reconfiguring production processes to minimise resource consumption and waste. In most cases, this approach offers net, long-term economic, as well as environmental, gains, as the efficiency of the system is improved.

Cleaner production begins to link innovation, R&D and economics to the issue and value of improving environmental quality. However, cleaner production also needs to take into account other components of the system, beyond the factory. After all, the purpose of production is the creation and sale of new products, and their transportation, use and ultimate end-of-life disposal all contribute to a range of environmental impacts. The economics of a particular system of production, consumption and end-of-life disposal—its resource usage and its environmental and social outcomes—all derive from the specific characteristics of an industrial product: its material composition, its energy consumption, its mode of operation and so on.

As concern about waste, pollution and environmental degradation has grown, the market for consumer products has become sensitive to issues of environmental quality. Over the past decade or so manufacturers have been forced to respond to an increasingly sophisticated focus on the environmental impacts of products and a growing demand for 'greener' goods.

Various European countries introduced 'product-oriented policies'—measures aimed at 'closing the loop' in the production–consumption system, eliminating or reducing waste and pollution at all points in the chain (Cramer 1993). These include the introduction of resource taxes aimed at stimulating more resource-efficient production and the better utilisation of recycled materials (by improving their costs relative to virgin materials). They also include product stewardship or EPR.

### 1.5.4 *The range of policies on extended producer responsibility in global markets*

Ten OECD countries have legislation in place that provides for regulations, covenants, ordinances or other mechanisms to impose EPR for particular product categories (OECD 1997). Product categories currently included in, or targeted for, EPR programmes in OECD countries and in the European Communities (EC) include packaging, tyres, batteries, waste oil, chlorofluorocarbons (CFCs), printed matter, electrical and electronic products, office equipment, cars, furniture, building products and agricultural plastics.

A number of different policy tools are used or are under consideration by governments to implement EPR. These include deposit–refund schemes, product disposal charges, voluntary agreements or covenants with industry to achieve waste targets and end-of-life product take-back requirements. Environmental labelling, environmentally based procurement programmes and minimum recycled content requirements are also considered as part of the EPR policy armoury (see e.g. Davis 1995: 95-109).

#### 1.5.4.1 Deposit–refund schemes

Denmark, Switzerland and Sweden have required makers and/or suppliers of small consumer batteries to levy a refundable deposit,[5] and Austria operates a similar policy for fluorescent lights and tyres. Korea has deposit–refund schemes covering beverage containers, batteries, tyres, televisions, washing machines and lubricating oils. Taiwan introduced a similar system for polyethylene terephthalate (PET) bottles in 1991 (OECD 1993).

#### 1.5.4.2 Advance disposal fees

An advance deposit fee is set to a level estimated to cover real disposal or recovery costs and is paid by the producer into a government fund. A variation on this approach is that consumers who handle the waste from a product in a certain specified way receive a refund of the fee at the end of the product's life. In Austria this approach is used for refrigerators, and in Sweden it is used for automobiles. In 1993 the State of Florida in the USA imposed a 1% fee on containers that had not achieved a 50% recycling rate. This scheme raised over US$44 million in its first year of operation (for a review of this scheme, see Boehm and Hunt 1995: 12-13). Hawaii enacted a similar fee on glass containers. Some 21 US states have schemes for tyres, and 10 US states and most Canadian provinces have systems for beverage containers (Lifset 1995: 37-51).

#### 1.5.4.3 Voluntary agreements and covenants

The UK Producer Responsibility Act 1995 essentially commits the government to negotiate with various industry sectors to achieve a waste reduction strategy acceptable to, and managed by, the industry. The Netherlands covenant system sets voluntary agreements within a framework of long-term targets and provisions for enforceable ordinances or regulations, should voluntary covenants fail to achieve the targets. A covenant on packaging wastes was the first result of the Netherlands approach; other agreements include one reached on automobiles, where the industry asked government to introduce a fee to support end-of-life recycling. This agreement is binding on all parties in the production chain. For

5 The scale and content of waste from batteries is illustrated by a 1993 German study: 800 million batteries were sold in Germany in that year, comprising 4,400 tonnes of zinc, 430 tonnes each of nickel and cadmium, 13 tonnes of mercury and 10 tonnes of silver. This represents almost a 100% increase over 1990 levels. In 1995 around 3 billion batteries were sold in the USA, most destined for landfill (*Warmer Bulletin UK* 45 [May 1995]: 23).

batteries, tyres and agricultural plastics, however, the Netherlands government legislated after it was clear that the industry sectors could not agree on a voluntary covenant. The Australian government has negotiated a voluntary packaging covenant with industry, supported by a legislative safety net to catch 'freeloaders'.

#### 1.5.4.4 Product take-back systems

Product take-back involves the establishment of set targets for collection and recovery of products, with laws, regulations or ordinances setting out the responsibility of the individual producer or importer to 'take back and recover' their products unless certain other conditions are in place. Industry-wide schemes are generally allowed for. The best known of the product take-back systems relate to packaging, with the German Packaging Ordinance and its industry-wide scheme for collection and recycling—the Duales System Deutschland—being the most prominent and most studied.[6] The German system is credited with reducing packaging waste. Plastic waste fell from 923 thousand tonnes in 1991 to 823 thousand tonnes in 1995 and is now a significant source of new jobs. Some 18,000 jobs were created directly by the Duales System.[7]

## 1.6 The competitive edge: the greening of the market

In Australia, environmental protection is still viewed by some (vocal) parts of industry as just another potential burden that will increase costs and reduce profits. In the European context (and to a great extent in the USA and Japan), regulations and policies to increase environmental protection appear to have become a new stimulus for innovation and to have led companies to identify new business opportunities. Leading companies—such as Xerox, Electrolux, Bosch, BMW, Philips, Volvo, AEG and Wilkhahn—have invested heavily in new processes, systems, production technologies and design methods in the search for dramatic reductions in the environmental impacts of their products. Such companies decide to invest in this way because they:

- Want to position themselves as market leaders and innovators
- Do not want future 'surprises' (they want to 'anticipate' the changing regulatory and market context rather than to 'react' to changes as they are upon them)

6 This ordinance requires that waste from packaging be taken back by producers and re-used or recycled independent of the existing public waste-collection system. Retailers must take back primary sales packaging. Any secondary packaging used for safety or security may be left by consumers at retail shops or supermarkets. Transport or shipping packaging must be taken back by manufacturers or distributors.

7 As reported by Dr Helmut Schnurer of the German Ministry for Environment, at Green Goods 3, the third international conference on product-oriented environmental policy, Oslo, 15–17 February 1996, organised by the Norwegian Ministry of Environment.

- Recognise the emergence of a new business paradigm and a new competitive terrain
- Desire to act responsibly (to have a clear conscience on the part of directors)
- Desire to influence the direction of regulations and legislation (in partnership with government and to secure their investment)
- Desire to strengthen technical competence and develop new areas of technical competency ('handling environment')
- Want to change or improve the market image of the whole company

No business that strives to remain competitive, open to new markets and new opportunities can afford to ignore the global demands for environmental quality. The international market for low-impact products is growing at an astonishing rate. In established industrialised markets such as Europe, the USA, Canada and Japan, the demand for such products, and the investment to create them, is driven by increasingly stringent regulations and standards. In the rapidly developing economies of Asia, demand is growing because of resource constraints in those regions that would otherwise limit the rate of development. Demand for 'cleaner and greener' products is also growing because investment in research, design and innovation is delivering new competitive products with greatly improved environmental efficiencies.

Whether through the market pull of environmentally aware consumers, the corporate foresight of industry or the radical regulatory shifts imposed by governments, the global market for manufactured goods is unequivocally reconfiguring itself to meet key environmental imperatives, albeit at different speeds by different industry sectors.

More and more companies are openly proclaiming their environmental intentions and credentials, recognising that increasingly astute consumers are 'putting their money where their mouth is' when it comes to purchasing goods and services. Environmental issues no longer relate solely to compliance, clean-ups and other end-of-pipe scenarios. The days of companies acting on environmental issues simply because they are required to by government are going, especially among OECD nations. Furthermore, the recent phase of implementing cleaner production or pollution prevention as a way of saving money (and protecting the environment) has also been acknowledged as an incomplete solution to minimising environmental impacts.

Companies are realising that the 'environment' is a source of innovation in its own right and provides a unique opportunity to boost competitiveness. The commercial edge possible through eliminating or minimising undesirable environmental impacts through DfE not only helps in saving money via the old cleaner production process but also can directly contribute to making money in a responsible manner—if cleverly executed. In many ways, DfE embodies the attitude of 'work smarter not harder'.

Global companies with long histories wish to remain competitive for many years to come, despite the usual machinations of restructures, amalgamations, takeovers and collapses. These companies can see that growing consumer awareness about environmental degradation will continue to mature and gather momentum, as today's well-informed and eco-oriented youths become more affluent consumers in the 21st century. In this instance it is neither government regulation nor the availability of cleaner production technologies that are the corporate stimulant for pursuing product-oriented environmental initiatives.

Companies know that their own economic sustainability directly depends on having a healthier environment and thus a flourishing society to which a product may be marketed. Sustainable companies will rely on sustainable products and services both to meet the need of more demanding customers and to help find and embody that competitive edge over more conservative companies who treat environmental protection lightly and with apathy.

Probably the strongest testament to the greening of the international market is the expanding number of companies seriously addressing environmental aspects as part of their product development process. These companies are global players seeking to maximise profits in volatile markets, so their decision to integrate environmental objectives holistically across all company operations, services, processes and products was unlikely to have been taken casually, even if government regulations did provide an incentive in some cases.

Overall the message is clear—DfE has a critical role to play in making companies more profitable over and above the need for environmental compliance. Just as the intelligent and effective use of conventional design has successfully transformed companies and their products into trusted household names, the ability for DfE to play a similar role can reap brand loyalty, consumer respect and the resulting commercial gains that logically proceed from this. In Box 1.2 the list of companies allocating substantial resources to DfE initiatives not only demonstrates serious corporate environmental foresight but is also an acute reminder that the sceptics indifferent to DfE have got it wrong—and most likely at great financial loss over the longer term.

## 1.7 Summary

This chapter has set out to provide an overview of the who, where, what and why of DfE. In some ways this contextual chapter is a small-scale map in need of closer scrutiny, observation and action. It highlights some of the key players in, and drivers of, DfE and offers some snapshot definitions, directions and explanations.

Although this chapter may have raised more questions than it has answered, the reader will find that the 'hands-on' chapters to follow begin to illuminate the approaches, guidelines, methods and case studies that can maximise the life-cycle environmental performance of everyday products. As mentioned at the beginning, an important underlying philosophy of this book is to assist all those

*The following lists are 'snapshots' and are by no means exhaustive.*

***Information technology and telecommunications***

- Xerox
- IBM
- Hewlett-Packard
- Compaq
- Siemens-Nixdorf
- Ericsson
- Nokia
- Motorola
- AT&T

***White goods and consumer electronics***

- Miele
- Electrolux
- Bosch
- Whirlpool
- Philips
- Loewe
- Toshiba
- Hitachi
- Sony

***Furniture***

- Wilkhahn
- Steelcase
- Knoll
- Haworth
- Herman Miller
- IKEA

***Carpets and flooring products***

- Interface
- Milliken
- Collins & Aikman
- BASF

***Automotive***

- BMW
- Daimler-Benz
- Renault
- FIAT
- Rover
- Volvo
- Toyota

*Box* 1.2 **A snapshot of companies pursuing cleaner and greener products**

involved in the product development process to better respond to environmental concerns without the need to become an 'environmental scientist' to do so.

Design is partly about problem-solving and therefore DfE is a very focused aspect of the process. However, design is also a highly creative human endeavour that can generate fun and desire while meeting the needs of society. In other words, avoid becoming a 'green and grumpy' designer and focus on how DfE can simultaneously fulfil the serious problem-solving aspects and the more whimsical and entertaining qualities associated with everyday products.

Above all, this chapter proposes a context within which design for environment has emerged, operates and evolves and thus a foundation from which to build and move onto action-oriented strategies and approaches that can be applied in practice.