Design for sustainable development

Success factors

EUROPEAN FOUNDATION
for the Improvement of Living and Working Conditions

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Foreword

The move towards sustainable development is one of the main challenges of the European Union. It is an essential principle of the Fifth Environmental Policy and Action Programme that environmental concerns are taken fully into account from the outset in the development of other policies and programmes. Because of its structure, the European Foundation for the Improvement of Living and Working Conditions can play a unique role in this area by working with the social partners and by carrying out research in areas where environmental issues and working conditions overlap.

Against this background, sustainable development was one of the six key areas of the Foundation's work programme for 1997-2000. The focus of the Foundation's activities on sustainable development was sustainable production and consumption. In order to deal with these issues, the Foundation launched a project on design for sustainable development with the aim of developing tools, information networks and training for the main actors concerned, such as industry, social partners and designers.

The principal objectives of this report are to analyse what constitutes successful sustainable design, to identify what are the barriers to sustainable design approaches – especially at small and medium-sized enterprise (SME) level – and to examine the processes and initiatives which can help overcome these barriers. The report also serves to recapitulate many of the themes encountered in earlier work both in this project and in the two related Foundation projects on economic and fiscal instruments and professional education and training for sustainable development, and hence represents a summary of the main findings of the Foundation's wide-ranging work over four years in this area.

In addition to being a synthesis exercise, the report also contributes valuable new material based on consultation with key players, which includes case studies and recommendations for further action to assist companies towards sustainable production at both national and EU level.

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Introduction

Context

This final report, prepared for the European Foundation for the Improvement of Living and Working Conditions, represents the final study under the Design for Sustainable Development framework project. The report aims to identify the success factors and processes which lead to sustainable 'design' in its broadest sense, meaning the whole industrial production process. It brings together some of the key aspects of the work that has been conducted over the last three years by the Foundation, notably on the use of economic instruments for sustainable development and professional education and training in this area. The report also analyses the wider literature and consultation and case study work carried out in this field.

The work primarily addresses the internal (workplace) and external (wider) environment and hence, to a degree, deals with health and safety issues as well as issues relating to pollution and resource consumption. It also touches on the wider social and economic aspects of sustainable development. In particular it deals with the issues surrounding small and medium-sized industrial enterprises.

Objectives and scope

While a considerable amount of research has been carried out in relation to some of the issues noted above, there has been relatively little work on the processes and mechanisms that facilitate more sustainable practices in industry and commerce. Clearly these may vary in the different circumstances that exist in different Member States, different sectors, different types and size of company, etc. Neither has much been done to try to understand the interrelationships that exist

between these factors and hence the potential for and benefits of a more integrated approach, both at the company and wider policy formulation level. The study therefore aims to identify what constitutes successful sustainable 'design', and in particular the role of a more 'integrated approach'; and in doing so meet the following two key objectives:

- to identify the barriers to 'sustainable design' approaches;
- to identify the step-by-step processes and key factors that can help to overcome these barriers.

To make the study manageable it has been limited to work that addresses the more practical aspects of:

- internal company structures, perceptions, motivations and 'culture';
- external support systems, including education and training;
- other external factors including:
  - economic/market conditions;
  - regulatory/policy frameworks;

where they apply to industrial (and to a lesser extent commercial):

- eco-efficiency (process optimisation);
- eco-design (product optimisation);
- sustainable (healthy, safe and pleasant) working environments;
- sustainable production in a wider sense (e.g. use of renewable resources).

While the study is wide-ranging, it does not cover regular end-of-pipe pollution control issues or remediation, for example of contaminated land or water. Neither does it address land-use planning and other aspects of the built environment (e.g. building design). These topics have all been outside the scope of the Foundation's recent work.

Approach

The study has used the following key steps to achieve the stated objectives:

- Review of studies carried out by the Foundation for the Improvement of Living and Working Conditions and other relevant literature;
- Identification of and consultations with key players;
- Identification and investigation of a small number of relevant case studies;

The work has been led by ECOTEC in the United Kingdom with support from their Madrid office and from Ole Busck of Plan Miljo in Denmark (occupational health and safety section). The work has been primarily desk-based, involving a significant element of information searching through the World Wide Web. A limited number of consultations have been conducted

by telephone. In order to make the work as systematic as possible, the researchers have used the framework shown in the box below as a guide while gathering information.

Literature and case study analysis framework

- Issue category – internal to company, external support, other external factors;
- topic category – eco-efficiency, eco-design, working environment, sustainable production;
- approaches and key elements;
- benefits and overall level of success;
- key process steps – cultural, educational, economic, legislative, technical, etc.;
- key barriers – cultural, educational, economic, legislative, technical, etc.;
- key success factors – cultural, educational, economic, legislative, technical, etc.

In terms of judging how successful various approaches have been, it is worth saying that ultimately society is trying to improve the sustainability of company actions and hence this study has taken an interest in the following types of measure as indicators of success:

Direct

- reduced wastage/pollution (per unit of production);
- reduced hazardnous of materials used and disposed of;
- reduced use of non-renewable resources (per unit of production);
- improved product longevity and recyclability;
- improved staff health and working conditions;
- increased employment.

Indirect

- company cost savings;
- introduction of Environmental Management Systems (EMS such as ISO 14001);
- introduction of integrated systems for health, safety, environment and quality;
- increased employee/stakeholder consultation and participation.

Chapter 1

Towards sustainable production in the European Union

Introduction

To put it briefly, sustainable development is about ensuring a better ‘quality of life’ for everyone, now and for generations to come. As such it is concerned with protecting and enhancing:

- the environment and its resources;
- economic conditions and wealth creation;
- social standards including health, safety and equity.

Making industrial and commercial practices more sustainable therefore naturally encompasses many aspects related to the supply of goods and services. It is clearly important to address a wide range of factors including:

environmental

- quantity and type of materials used;
- quantity and source of water and energy used;
- process emissions and wastes;
- transport impacts;
- impacts on wildlife and biodiversity;

social and economic

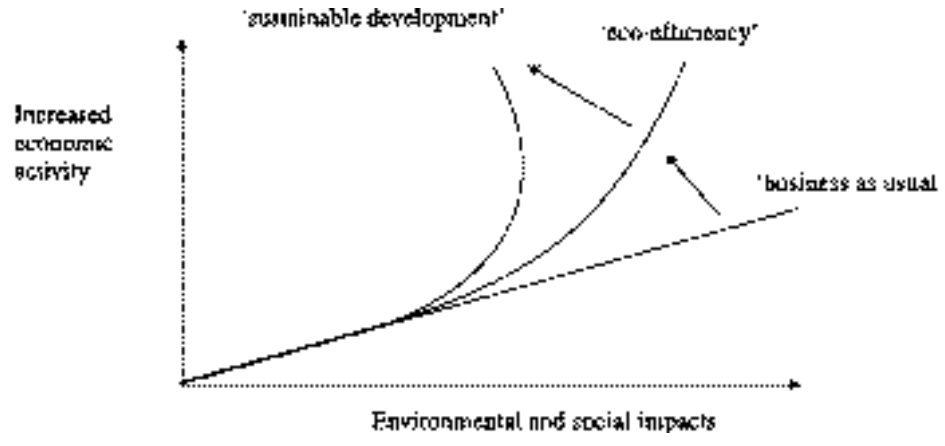
- worker health and safety;

- nuisance and impacts on amenity (e.g. noise, visual impact, access, etc.);
- worker involvement and acceptance;
- community involvement and acceptance;
- quantity and quality of jobs;
- standard of living;
- equality of pay and conditions;

Considerable protection is provided by existing legislation across the EU which aims to prevent and control pollution and mitigate against the impacts of development. Important directives include the Integrated Pollution Prevention and Control (IPPC) Directive, the Dangerous Substances Directive, the Industrial Solvents Directive, the Packaging and Packaging Waste Directive, the Waste Incineration Directive, the Landfill Directive, the Environmental Impact Assessment (EIA) Directive and many more.

While there has been a recent shift to preventative and producer responsibility legislation (e.g. IPPC, Packaging Directive), until the 1990s the majority of the legislation primarily addressed pollution control through 'end-of-pipe' measures to meet minimum standards. Making production and consumption more sustainable, however, requires far more, particularly in terms of resource efficiency. By shifting onto an eco-efficiency growth path, economic growth can be achieved with far less negative environmental or social impact (Figure 1 below). The concepts of waste minimisation, recycling, energy efficiency, cleaner technology, and eco-design all fit in with this idea of getting more from less whilst doing less harm to those inside the workplace and those outside it.

Figure 1 Moving on to a more sustainable growth path



Numerous practical initiatives in Europe and in the USA have shown that there are many clear benefits to be gained from eco-efficiency and design, including very significant cost savings and much wider sustainable development savings (See next section). Work in Germany (Wuppertaal Institut), the Netherlands (CLMT, 1990) and the USA has suggested that eco-efficiency and

design work can in fact reduce pollution and resource consumption per person by a factor of perhaps two to four times (i.e. 25% to 50% of current levels), an idea recently expressed through the Factor 4 concept.

While the eco-efficiency, design and health and safety measures can take us a long way in terms of dramatically improving the internal (company) and wider (external) environments, society also has to adopt some fundamentally new ways of doing things if we are to progress to a truly sustainable path. By this is meant a state whereby society can continue to achieve economic growth with no further negative environmental or social impact and hopefully a reversal of some of the decline that has already taken place. Work in the Netherlands (Weterings and Opschoor, 1992), Germany and the USA has suggested that to achieve true sustainability we need to reach a Factor 10 to Factor 50 situation, i.e. only 2% to 10% of current pollution and resource use levels. This is obviously a very great challenge, not just in terms of the technologies needed by society , but in terms of the whole manner in which society goes about producing and consuming goods and services.

A lot has been written about what constitutes a 'sustainable enterprise', one of the earliest references being Schumacher's *Small is Beautiful* (1973) which emphasised the need for localised production and consumption using more appropriate materials and technologies. Nearly thirty years on, the subject remains open to debate, however it is widely accepted that in the environmental sense we are talking primarily about eliminating non-renewable resource use and pollution loads which are beyond nature's 'carrying capacity' (i.e. its ability to deal with them). In practical terms this means eco-efficiency and eco-design plus the substitution of services for goods (dematerialisation) and the substitution of renewable resources, including ones already in the consumption cycle, for non-renewable ones, both in terms of the materials and energy sources used in and by processes and products. One can imagine, for example, the manufacture of natural (e.g. wool and cotton) textiles using natural dyes and energy from renewable sources as a truly sustainable process.

Sustainable development is about more than environment, however, and it is also necessary to consider maintaining and improving socio-economic conditions. The 'sustainable enterprise', therefore, is also one that maintains or improves 'quality of life' for its employees and those in the local community, through providing for other human needs such as health and safety, job satisfaction, job security, equity, inclusion, free time, etc. It is interesting to note here that it is often small and micro enterprises in the less developed countries (LDCs) that offer some of the best examples of truly sustainable enterprises. Poverty and lack of access to expensive western technologies and materials have generally made local self-sufficiency, using renewable resources and often through co-operative ventures, a necessity for survival. As a result, many are using materials and methods that have long since been forgotten or abandoned in the West. While the developed countries have a lot to offer the LDCs, the opposite can also therefore be true. More on the subject of what makes a sustainable enterprise can be found in the *Practical Examples of SMEs* report and the Foundation publication, *Concepts and Ideas.*

Progress in the European Union

So how much progress has the EU made along the road towards truly sustainable development? This is not such an easy question to answer definitively. In recent decades there have certainly been very positive developments, for example in terms of the adoption and implementation of key EU principles such as the Polluter Pays Principle, the Precautionary Principle and the principle of Preventative Action. The late 1980s and 1990s heralded a shift to more preventative regulation which addresses eco-efficiency and eco-design as well as 'end-of-pipe' control. Recent examples here have included the Packaging and Packaging Waste Directive, the IPPC Directive and the Industrial Solvents Directive. There has also been considerable activity in terms of management systems and tools. In terms of the former there has been considerable uptake of environmental management systems (EMS), particularly EMAS and ISO14001. In terms of the latter, one of the most important developments has been the life cycle analysis (LCA) approach and the use of associated design tools and eco-labels including the EU 'flower' Eco-Label and the well-known German Blue Angel and Nordic Swan systems.

As the recent Foundation study, *SME Support Systems for Sustainable Development*, makes clear, there has also been no shortage of support initiatives across the EU. The vast majority of these initiatives have been in the eco-efficiency (e.g. waste minimisation) and EMS area with far fewer initiatives dealing with eco-design, integrated approaches (for example including workplace health and safety) and more fundamental approaches to 'sustainable production' encompassing such things as the use of renewable energy and materials (e.g. non-food agri crops). Most of the activity in the sustainable manufacturing area is in fact currently aimed at supporting research and development/demonstration projects rather than mainstream implementation.

But what of companies themselves? In most industrialised countries, including the EU Member States, there is a situation whereby a significant minority of companies are moving into a less damaging mode of operation through eco-efficiency and design activities. Some companies have made very significant progress, for example achieving zero-discharge manufacturing and symbiotic waste exchange. There are also examples of more sustainable production and service provision, for example in terms of companies making goods from renewable resources (e.g. hemp) and through 'dematerialisation' – the greater use of services (e.g. renting of vehicles rather than ownership) and the information and communications technologies (e.g. rather than paper-based systems).

Essentially EU companies are collectively moving up what one might call the sustainable production hierarchy as described in the box below. Often the activities of these companies is widely publicised through case studies and media articles, perhaps giving the impression that such progress is widespread. It is fairly clear however, from the statistics, recent experiences and surveys, that the vast majority of EU companies, particularly SMEs, have yet to adopt environmental management systems and/or proven waste minimisation practices let alone more fundamental approaches to sustainable production.

The sustainable production hierarchy

- sustainable production – elimination of non-renewable resource use;
- more integrated approaches – relating health, safety, environment and quality;
- eco-design – product optimisation, design for recyclability, etc.
- eco-efficiency – process optimisation (waste minimisation, yield maximisation);
- pollution control and compliance – end-of-pipe approaches.

While resource efficiency improvements have been made, economic growth tends to be outstripping these improvements, at least in certain regions and in relation to certain issues. To give some examples, it is thought that UK waste arisings (compounded over the last five years) have grown faster than recycling activity while energy usage has increased by 4% despite a 13% fall in energy 'intensity' (ENDS Daily, 10 August 2000)[1]. In the USA a recent study on the effects of the Toxic Release Inventory (Hampshire Research Institute, 1998) showed that while there had been an overall 17% reduction in the 300 listed chemicals between 1991 and 1994, there had been an 8% increase in other production-related wastes.

Packaging has generally become lighter as have certain products but to an extent this is countered by increasing consumption. While mobile phone have become much smaller and more resource efficient, demand has grown dramatically over the last decade, increasing the number of phones per household and hence resulting in an absolute increase in resource consumption. In relation to 'dematerialisation', Salzman (2000) notes, in his research into the effects of the increasing dominance of the service sector in the US, that this change in emphasis has not led to the overall benefits one may have intuitively expected for the same reasons, i.e. growth again outstripping improvement.

It is also clear that in many cases employers are still providing working conditions that are prejudicial to workers health and safety. The UK Health & Safety Executive, for example, in their document *Developing an Occupational Health Strategy for Great Britain* (HSE, 1998) notes that while accident rates have dropped dramatically, around two million people in the UK still report that they are suffering from illnesses caused by their work. The UK HSE and the Foundation's European Survey of Working Conditions (1997) both indicate that musculoskeletal conditions and stress are the most important areas of concern.

SMEs and sustainable development

While such issues affect companies of all sizes, SMEs are recognised as being of particular importance. SMEs are crucial to any nation's economy and in the EU they represent over 99% of enterprises and 65% of employment (EUROSTAT, 2000). In manufacturing (which accounts for

[1] Greenhouse gas and acid gas emissions have actually dropped in absolute terms, however.

around 29% of total employment) they account for 55% of employment. In terms of their environmental impact good quality data is somewhat scarce, however a study by the UK Environment Agency (2000) indicates that more than 50% of waste in the UK is generated by SMEs. Others in the UK (Hillary, 1995) have suggested that as much as 70% of pollution is generated by SMEs while a study by TNO (1997) in the Netherlands indicated that smaller (non-IPPC) installations contribute over 50% of the overall environmental load in relation to waste, Volatile Organic Compounds (VOCs), ozone depleters, ammonia, soil contamination, pesticides and eutrophication of water and around 40% in relation to energy consumption, greenhouse gases and acidification.

The picture in terms of occupational health and safety is a little more confused. Some of the data suggest SMEs are lagging behind larger enterprises, certainly in terms of accident prevention. For example, the accident rate in businesses with less than fifty employees is around 20% higher than in businesses with between 100 and 1000 employees (European Commission, 1995). Figures quoted in a comparative study carried out by EIRO found that in Belgium, accidents at work occur with 50% more frequency in SMEs than in larger companies(EIRO, 1999). Moreover, a 1997 survey on risk assessment indicated only 20% of very small enterprises conducted such an assessment compared with almost 70% of enterprises with 250 or more employees (Zoetermeer, 1998). The Foundation's 1997 survey on working conditions indicates that, according to the employees questioned, SMEs are no worse in broad terms than all but the largest firms although further analysis (EFILWC, 2000) shows that workers in micro firms (1 to 9 employees) generally do tend to be a little worse off than average, suffering from more physical and psychological health problems.

While it is known, in the wider 'support' community, that SD-related activities are of benefit to SMEs as well as larger companies, in economic terms as well as environmental and social terms[2], SMEs seldom act without considerable prompting and support. While most SMEs have serious resource constraints they also have the advantage of being less bureaucratic and more flexible than larger companies, giving them the opportunity to innovate. Reaching SMEs, therefore, is essential if society is to make serious progress towards the goal of true sustainable development. Despite the fact that support initiatives are getting more SME-focused (EFILWC, 2000), the engagement of SMEs is still a huge problem with only a very tiny fraction making any sort of substantive improvements.

Providing the conditions for change

Overall it is clear that we are still far from the 'sustainable development' paradigm in the commercial and industrial sector in the EU. The lack of progress by SMEs and larger companies not only contributes to environmental damage and unacceptable working conditions but also limits competitiveness. This can lead to the failure of businesses and the loss of employment,

[2] Waste minimisation work, for example, has been shown to significantly improve SME profitability, often adding 10% or more to the bottom line profit.

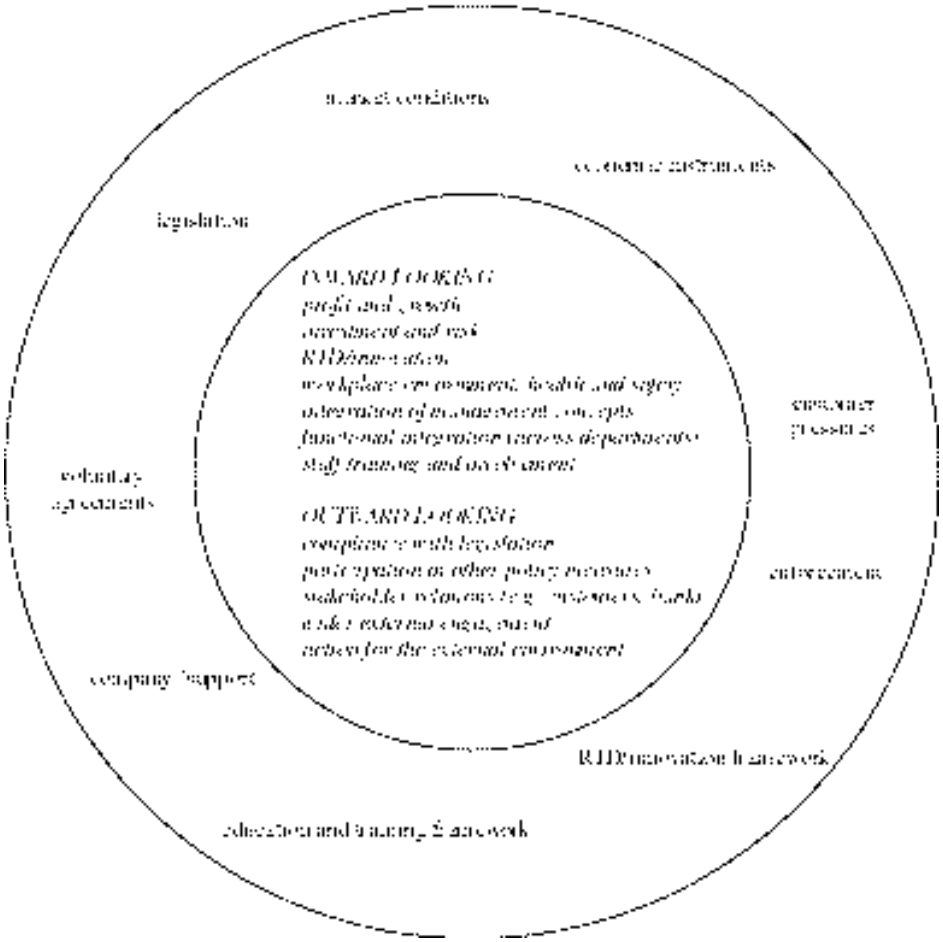
with all of the negative social consequences that that involves. It is therefore important, both from the perspective of policy makers and companies themselves, that the right conditions and measures are put in place to encourage, perhaps even to force companies, to move quickly towards the sustainable development path.

There are clearly a large number of 'internal' and 'external' factors to be considered, for example:

- Internal: the 'culture' and organisation of companies;
- External: the context in which companies operate.

Figure 2 below sets out some of the factors that influence company behaviour. It is worth noting that one can split the 'internal' factors into those that are inward looking and those that are outward looking. Clearly providing the right conditions for sustainable development is not a simple matter, requiring a multi-faceted approach. The Foundation's research programme has covered many, although not all, of these factors and this work and that of others will be brought together to try and summarise the situation under the key headings noted below.

Figure 2 Internal and external factors influencing companies



Chapter 2 Organisations and their behaviour

Organisations of all kinds, private and public, are complex in that they each have different structures and hierarchies, different methods of internal communication, different decision making processes and of course different people with different personalities and experiences. Before having a chance of being effective in influencing them, we need to at least partially understand how they ‘tick’, i.e. what their attitudes are and more importantly what motivates them to take action.

This is clearly not a simple matter and something that will change from region to region, sector to sector and even company to company. There will, however, be some common factors that can be identified and worked on and some clues as to how external interventions can be modified to suit particular circumstances. This chapter aims to examine the current situation in terms of company awareness, attitudes and motivations in relation to more sustainable practices and examines company actions and achievements in various fields.

Awareness, attitudes and motivation

Environmental issues

For many years the majority of companies, and in particular SMEs (KPMG, 1997), have thought of ‘environment’ and sustainable development as being ‘external’ or at best peripheral to their business activities. Many, particularly SMEs, still feel that ‘environmental’ or SD activity is something that is not their responsibility so long as they remain within the law and/or that they do not have a very significant environmental impact and/or that they have already done what they can to minimise that impact. A recent Welsh survey (Arena Network, 1997), for example, indicates that around 30% of small companies (25 to 49 employees) thought that they had no

impact while around 60% felt that they had adopted best practice. A Belgian study by UWE[3] indicated that 84% of Belgian SMEs do not feel that they contribute to soil contamination, 44% believe that they do not emit any polluting substances to the air and 23% claim not to produce any solid waste. These views go firmly against what data there is (e.g. Environment Agency, 2000) and the experience of those involved with SMEs.

With regard to southern Europe, a survey of 20 Spanish-owned SMEs in Catalonia (Anglada, 1997) indicated that managers now largely believe that there is a real problem with regard to the impact of business on the environment. These managers, however, tend not to take responsibility for these problems and have a poor understanding of what is required of them. In Spain a large industry survey conducted in 1997 (covering mainly SMEs but few with less than 20 employees) by the Fundación Entorno (Environment Foundation), notes that awareness/concern over environmental damage caused by industry appears to vary across Spanish regions with those least aware/concerned being in the Canary Islands, Castilla y León, Madrid, Murcia and the Basque Country, with those most aware/concerned being in the Balearic Islands, Cantabria, Extremadura, Asturias and Andalucía. It is interesting to note that there is not an evident correlation between the degree of economic/tourist development and environmental awareness/concern.

While the picture is somewhat bleak, recent surveys show that environmental issues are rising up the business agenda. In northern Europe particularly, and even in the UK which has perhaps been less pro-active than some Member States (e.g. Germany, Netherlands, Denmark), environmental issues now seem to be taken seriously by most. The 1998 Groundwork Survey of 300 UK SMEs (Small Firms and the Environment) showed that environmental issues were now considered as being far more important than such matters as quality control and safety (which presumably are thought to have been dealt with), broadly as important as such matters as productivity, interest rates and meeting statutory requirements but far less important than labour issues and competitiveness. This increased concern is far from universal, however. The 1997 Welsh survey (Arena Network, 1997) indicated that environmental issues were at the bottom of the business agenda in Wales where unemployment is high and competitiveness hard to maintain.

In terms of general awareness, it is generally accepted that most EU businesses have a reasonably good general knowledge of topical environmental issues (e.g. global warming) but have a far poorer understanding of the details and the relevance to industry and commerce (e.g. impacts of process emissions). The recent work on education and training for the Foundation (ECOTEC, 2000) suggests that awareness varies across the EU with certain countries (e.g. the Netherlands) being perhaps somewhat better than others (e.g. the UK) in this regard.

[3] Survey by the Walloon Employers Federation (UWE)1997.

Legislation and EMS

In the UK, where various studies have been undertaken in recent years, it even seems that awareness of current legislation is poor, particularly in relation to specific issues and requirements (Groundwork, 1995/1998, Petts, 1999). In the 1998 Groundwork survey of UK SMEs only 6% noted the Water Industry Act and 5% the Duty of Care waste regulations, both of which affect almost all companies. Only 15% of respondents noted the 1997 Packaging Regulations which have recently received a lot of publicity.

A 1997 study of Welsh businesses (WEC, 1997) showed that over 50% of companies claimed to be aware of the basic waste management Duty of Care requirements, the Special Waste Regulations, the Packaging Regulations and the Landfill Tax while far fewer were aware of other important issues including ISO14001 and local waste minimisation schemes. The study showed that members of the Wales Environment Centre (WEC), and larger companies (200+ staff), had a far better awareness than non-members and smaller companies (less than 200 staff). Petts, in her study of UK SMEs and environmental compliance (Petts, 1999) notes that the majority of UK SMEs are 'vulnerably compliant', i.e. that they do not know enough about legislation to ensure that they are always compliant. More worryingly still, a survey in the mid 1990s (Hillary, 1995) indicated that 40% of SMEs did not expect further environmental legislation to have any effect on their business.

This is clearly not just a UK problem, with a similar lack of legislative awareness being an issue in most parts of the EU, particularly amongst SMEs, as indicated by the work of KPMG (1997) and others. Pederson notes that with regard to Danish SMEs, they are often so ignorant of regulations that they are too embarrassed to ask for help. The 1997 Spanish study by the *Fundacion Entorno* notes that while 55% of companies surveyed know the legislation 'quite well' these tend to be the medium to large companies. Various researchers (e.g. Charlesworth, 1998, Smith and Kemp, 1998) note that awareness of EMS is also very poor amongst UK SMEs. Lack of awareness is not just an EU problem of course. The Australian study noted above (Gerrans and Hutchinson, 1997) indicates that only 8% of respondents had knowledge of the key piece of environmental regulation in Western Australia, the Environmental Protection Act, while only 5% were aware of ISO 14001.

It is generally understood that most companies want legislation (of all kinds) that is clear, simple and not too strict. This is particularly true of SMEs who often see legislation as being too complex and demanding (KPMG, 1997) and in some cases lacking in overall environmental justification (Petts, 2000). Anglada (1997) indicates that Catalan SMEs feel that regulation is too severe and inflexible, with too little time being given to adapt.

Despite these views, a recent survey by EuroStrategy Consultants (noted in the KPMG report, *The Environmental Challenge and SMEs in Europe*, 1997), indicated that most SMEs in Europe want to see 'command and control' systems in place and regulation enforced rigorously so as to provide a truly level playing field for commercial activity. The only exception was companies in the Netherlands where self-regulation (through negotiated agreements) is a more widely accepted

approach. This attitude to the problem of 'free riders' is also widely expressed in the UK where it is commonly believed that certain other EU states are less diligent than the UK in enforcing (rather than adopting) EU regulation.

In terms of EMS, various commentators (e.g. Charlesworth, 1998, KPMG, 1997, Hillary, 1999) have noted that most SMEs have a very negative view, seeing such systems as being bureaucratic and without tangible benefit. Hillary (1999) notes that bad experiences with the ISO9000 series put companies off ISO 14001 while public reporting requirements are a particular disincentive with regard to EMAS.

Health and safety

In terms of health and safety, one can say that the situation appears to be somewhat better than in relation to environmental compliance and eco-efficiency. In all EU Member States there is a legal requirement placed upon employers to meet certain workplace standards and in most cases to train staff in appropriate procedures. This legislation tends to be taken more seriously on the whole than the environmental legislation.

In a UK survey on compliance (Petts, 2000), 60% of respondents noted that they had disciplinary procedures in relation to health and safety while only 42% noted similar procedures in relation to environmental controls. In the 1998 Groundwork Survey of SMEs, the most often cited items of legislation were the Control of Substances Hazardous to Health and the Special Waste Regulations (both mentioned by 17% of companies), which relate to hazardous materials in and outside the workplace respectively. Interestingly, however, less than 5% of respondents noted the Health and Safety Act 1974 (the key piece of primary legislation) as being of 'environmental' relevance.

Eco-design and sustainable production

In terms of awareness and attitudes to eco-design, the situation is believed to be pretty much the same as with general eco-efficiency issues, i.e. that many are aware of the general concepts, but few outside the large and multinational companies are convinced of the benefits and are making serious efforts to incorporate them into their everyday activities. In terms of legislation, it is worth noting that in the UK the limited evidence suggests that only a small proportion of SMEs are aware of the essential requirements' aspects of the Packaging and Packaging Waste Directive (now separate regulations in the UK) which have clear eco-design implications relating to minimisation, reuse and recycling.

There does, however, appear to be quite good awareness (at least in general terms) of the forthcoming Waste Electrical and Electronic Equipment (WEEE) Directive and the End of Life Vehicles (ELV) Directive. While the industries in question may not want this new legislation, the medium to large companies are certainly getting to a stage where they can deal with it effectively. In terms of sustainable production, little appears to be known about awareness and attitudes amongst EU companies. While there are EU companies practising certain aspects of sustainable production, at present much of the work in this area is at the research and development stage and

only involves larger corporations. As such it is likely that the concepts are less well known and understood than, for example, the concepts of eco-efficiency.

SD-related benefits and awareness

Eco-efficiency measures have been shown to bring significant savings in most circumstances, for example in relation to:

- reduced material use and solid waste generation;
- reduced water use and effluent generation;
- reduced energy use;
- reduced emissions to air;
- reduced hazardnous of wastes and emissions;
- reduced risk of non-compliance/accident;
- improved productivity.

All this, of course, is good business practice and fits in well with quality management and production efficiency ideas. Such measures can also provide for:

- a more pleasant, healthier and safer (more sustainable) workplace environment;
- a better external local environment.

All of these direct improvements generally lead to some if not all of the following commercial and wider benefits for the companies themselves:

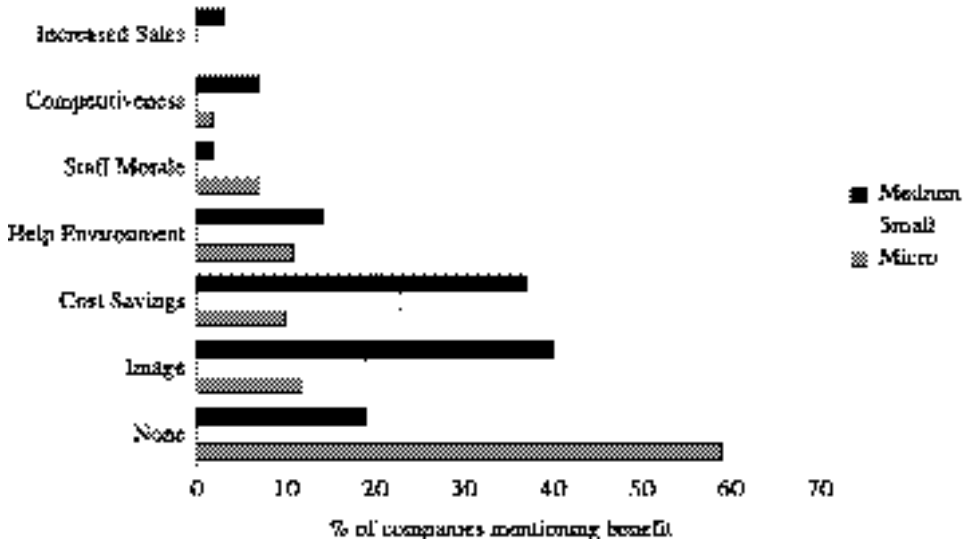
- reduced operating costs;
- reduced compliance/abatement costs;
- reduced insurance premiums;
- reduced cost of sick leave;
- better employee relations and retention;
- easier recruitment of quality staff;
- better relations with the local community;
- better relations with the regulator/s;
- better relations with customers and improved public image.

In general, pro-active eco-efficiency and health and safety approaches have been shown to lead to more efficient and profitable operations (CEST, 1997/98, van Dijken et al, 1998, Zwetsloot and Bos, 1998), with management time focused on outputs rather than dealing with ‘problem’ issues. Waste minimisation and energy efficiency initiatives invariably lead to yearly savings in the region of 2% to 5% of turnover while eco-design surveys (e.g. Open University, 1996) have shown benefits in terms of improved sales and market share. Inherently safer processes and

products can lead to production efficiencies (e.g. due to reduced maintenance down time) as well as direct employee benefits (e.g. improved workplace air quality). This all helps to improve company competitiveness, leading to job security and hence greater stability in local communities.

It is therefore worrying that there is an apparent lack of awareness of the benefits of eco-related and wider sustainable development improvements, most companies equating such improvements only with costs. Figure 3 below shows the results from the 1998 Groundwork Survey, indicating that amongst small and micro SMEs only a small proportion of firms are aware of the potential cost savings and a very high proportion think that environmental improvements offer no benefit to their companies. The situation appears to be similar but perhaps more extreme in Spain where the vast majority of small companies appear to view environmental protection as extremely costly and of virtually no benefit (Anglada, 1997). In the Australian survey mentioned above, only 26% of respondents saw environmental issues as being of relevance to competitiveness.

Figure 3 Perceived benefits of improved environmental performance



Source: Groundwork Survey – Small Firms and the Environment (1998).

It is worth noting that in most Member States ‘environment’ has for the last two decades been associated primarily with end-of-pipe pollution control and waste disposal for compliance rather than resource efficiency measures which invariably save companies money. SMEs do not generally make the link between process and product improvements and ‘environment’ or SD, even where resource savings are clearly being made. For example, most only regard their actions as environmentally related if they are environmentally motivated, directly or indirectly (e.g. through a need to be compliant).

It is clear that the situation is far better in the larger companies, especially the multinationals. A recent Arthur D. Little survey (ADL, 1998) of ‘corporate’ executives in Europe and the USA

indicated that 83% of respondents agreed with the statement that 'companies can develop real business value and economic growth from sustainable development initiatives'. The authors note that by SD initiatives most are referring to eco-efficiency measures alone rather than the wider definition which of course also takes in to account social factors.

On the subject of misinterpretation and use of language, one is left wondering whether attitudes to 'environmental improvement', as assessed by some of the surveys noted above, relate primarily to 'end-of-pipe' measures, while attitudes to SD measures relate primarily to eco-efficiency. This is more than just a matter of semantics as it can have a major impact on the way which initiatives are received and implemented. This is something that is discussed further below.

Pressures and motivations

A number of studies have investigated pressures and motivations in relation to environmental improvement. While there is clear evidence that individuals in companies are often 'eco-motivated' (Petts, 2000), it is widely accepted that the vast majority of companies do not act purely for ethical reasons. There is, however, quite good information on what does motivate them. The 1995 CEST (Centre for the Exploitation of Science and Technology) Survey on the Adoption of Waste Minimisation and Cleaner Technology in the UK, indicated that the main motivating pressures were regulatory compliance (over 70% of companies), community views (around 50%), operating costs (around 40%) and customer-related issues (around 35%). The 1997 WEC survey of Welsh businesses, also indicated that legal compliance was the most important factor, closely followed by employee views, community views, financial benefits and supply chain pressures.

However, other work in the UK (e.g. Groundwork Survey, 1998, Petts, 1999) has indicated that potential cost savings, customer relations and company image are more important motivators for companies than even regulatory compliance. A 1995 UK survey of eco-innovators by the Open University in 1996 indicated that the main motivation for creating 'green' products was to create entirely new niche markets or to improve market share, although company ethics and image issues also play a part. It is certainly clear that supply chain pressure (particularly from large companies to their smaller suppliers) is becoming an increasingly important motivation, especially with regard to the uptake of EMS.

Turning to other parts of the EU, a survey of Scandinavian business leader attitudes to environmental improvement (as reported in KPMG, 1997) indicated that over 70% of respondents did not believe that market factors alone (e.g. supply chain pressure, cost savings, company image, etc.) would be an adequate driver of change. In Spain a large industry survey conducted in 1997 (covering mainly SMEs but few below 20 employees) by the *Fundación Entorno* (Environment Foundation), found that compliance was by far and away the main motivator of environmental improvement, irrespective of the size of the industry and the economic sector to which it belongs. Other lesser factors were company image, reduced operation costs, market pressures and concern for the environment. Market pressures were more

evident in the high-tech sectors, such as the electronics sector. Anglada (1997) maintains that SMEs in Catalonia are primarily driven by legislation and the need to reduce risk and improve safety, there being little understanding or acceptance of the potential cost savings. Conversely, cost savings tend to be a more important motivator than regulation for Dutch SMEs, seemingly due to the partly self-regulatory nature of the Dutch system (ECOTEC, 2000) and the better awareness of benefits of SD-related improvements. The recent Joint Research Centre report on *Eco-Design in Europe* (JRC, 2000) notes that "the main driver is … benefits from a business perspective."

In terms of occupational health and safety (OHS), one can argue that there are fewer incentives to adopt better practices and management systems. However as Zwetsloot and Bos (1998) note in the Foundation's Report on Environmental Management and Safety and Health, there are real benefits to be made for example through:

- reducing the cost of employee sick leave;
- reducing liability (a real problem in an increasingly litigious society);
- making the company more attractive in competitive labour markets.

With regard to supply chain pressure, it appears that customers may be less concerned with OHS knowing that firms have to comply with the law. That said, companies that are going on to develop policies on sustainable development or ethics may become increasingly interested in this and other 'social' aspect of their suppliers practices.

One can conclude from the above that there are significant differences in the perceived pressures and motivations across the EU resulting from the cultural differences as well as the policy frameworks in place in each Member State. While the result may be the same, i.e. general inaction, the underlying reasons (perceptions and motivations) appear to be subtly different from region to region. There are also differences between subject areas, health and safety being perceived quite differently from waste/pollution control, which is also perceived differently from eco-design. As one would expect, the situation is not a simple one.

Company actions and achievements

It is certainly clear that there are now a significant number of companies, large and small, which are adopting EMS and taking forward various sustainable development, and particularly eco-efficiency, measures. While there is much evidence of specific actions by individual companies, for example through case studies, there is relatively little firm quantitative evidence in relation to the actions of the industrial and commercial sectors as a whole. Before continuing with a discussion on design for sustainable development in Chapter 3, its is therefore worth reviewing where the EU is in terms of tangible progress so as to put into perspective what still needs to be done.

Environmental expenditure

Some countries conduct environmental expenditure surveys to assess progress and the financial 'burden' that regulation and control can bring. The 1997 survey by *Fundación Entorno* (Environment Foundation) in Spain indicated that around 80% of companies made some sort of environmental investment during 1996, although around 70% spent less than 0.5% of their turnover. The typical profile of a company undertaking an environmental project was one with a turnover of 4,5 million euro or more and a minimum of 100 staff. Companies in Cataluña, the Basque Country and Madrid made the heaviest investments. Given that 41% of the expenditure is dedicated to the modification of production processes and 65% overall to reduction and recuperation, the Foundation concluded that industry had moved towards a more preventive approach.

The 1997 UK survey of environmental expenditure and the more recent follow-up survey (1999) also show that the vast majority of companies surveyed had made recent investments (ranging from waste storage bins to incineration equipment) with some sort of environmental objective. Most of this expenditure, however, is related to regulatory compliance rather than voluntary action and few companies noted the benefits of waste minimisation and the adoption of cleaner technology. Table 1 below shows the percentage environmental expenditure (including capital expenditure and operating costs), as a total of industrial environmental expenditure, by company size for some of the highest spending sectors.

Table 1 Percentage environmental spend by sector/company size

Sector	0-49	50-199	200-499	500+	% of UK Total
Printing	5	27	66	2	3
Food and drink	6	39	19	36	14
Chemicals	3	13	21	63	21
Plastics	6	23	55	16	4
Textiles	1	80	15	4	4

Source: DoE Survey – Environmental Protection Expenditure by Industry (1997).

While there is considerable variation, it is clear that the small and micro SMEs, despite their large numbers, spend a small proportion of the total for their sector. The overall figures for the UK demonstrate this since small/micro SMEs spend around 7% of the UK total but represent 16% of the turnover, while medium-sized SMEs spend 18% of the total and represent only 15% of the total turnover. This supports the assertion that the smallest SMEs are under relatively little environmental pressure compared to larger companies.

Environmental management systems

While environmental management systems (EMS) do not guarantee that actual substantive improvements are made, they do at least indicate a willingness to deal with environmental issues

in a robust and systematic way. Table 2 below summarises the situation with regard to accredited EMS in the EU.

It is interesting to note that the EMS uptake per 1,000 companies tends to follow quite well the received wisdom in terms of which are the more and less 'green' of the Member States, with Sweden, Denmark, Austria, Germany, Finland, Ireland and the Netherlands having the highest participation rates (above 1 EMS registration per 1,000 companies), and Italy, Portugal and Greece the lowest. It is clear that while the total number of registrations seems impressive, these companies are in a tiny minority, in fact less than 0.06% overall[4]. Even taking out sole traders (almost 50% of all companies) on the basis that they have very small individual and collective impacts, we still have only around 0.1% of companies registered. To put this into perspective, that means there are over nine million small, medium and large sized EU companies that do not have a registered EMS.

Table 2 Numbers of registered EMS sites in the EU (approximate)

Member State	EMAS total	EMAS Services (unofficial)	ISO14001	Total EMAS/ ISO14001	Number of Companies ('000s)	Registration per '000 SMEs
Germany	2432	310	1950	4382	3,261	1.34
Austria	262	29	223	485	243	2.00
Sweden	180	21	1121	1301	243	5.35
Denmark	144	7	350	494	164	3.01
UK	112	39	1014	1126	3,313	0.34
Spain	56	1	430	486	2,403	0.20
France	36	0	550	586	2,322	0.25
Finland	30	0	347	377	194	1.94
Netherlands	25	0	606	631	516	1.22
Italy	25	0	246	271	3,798	0.07
Belgium	9	0	130	139	518	0.27
Ireland	7	0	96	103	76	1.36
Portugal	2	0	15	17	642	0.03
Luxembourg	1	0	6	7	19	0.37
Greece	1	0	10	11	733	0.02
TOTAL:	3,274	407	7,094	10,416	18,445	0.57

Source: European Commission (EMAS), German Environment Agency (reprinted in ENDS Daily (11/05/2000), ISO web site/Swedish certification web site (both July 2000).

[4] Note that some companies have EMAS and ISO14001 hence making these figures optimistic.

That said, there are known to be many companies which have an EMS, or are developing one, but which have not obtained accreditation. In the case of the Netherlands for example, a KPMG survey for VROM (1997) indicated that even amongst small SMEs with 'significant environmental impacts' (and the definition of this is not clear), the proportion of companies advanced in the implementation of an EMS had increased from 8% in 1991 to 29% in 1996 and that only 7% were not considering an EMS at all! This either suggests that a very high proportion of companies have non-accredited systems or that they have made misleading statements in reply to the survey. By contrast the 1997 Spanish survey by the *Fundación Entorno* found that 62.8% of the companies questioned had no intention of developing an EMS.

This takes us back to the subject of motivation and the fact that some companies want only to improve their performance while others also, and in some cases only, want an 'eco-badge' to improve their image. Even if there are ten times as many companies which have an EMS (informal or otherwise) as are accredited, which seems optimistic, this still leaves us with only around 1% of non-sole-trader companies with an EMS (100,000), 99% without. Assuming that only 25% of these companies without an EMS have significant environmental effects (i.e. disregarding certain service sector companies), this still leaves us with around 2.3 million small and medium-sized EU companies that would benefit from an EMS[5].

While company size is not generally recorded when companies are registered there are some national data and estimates. Hillary (2000) estimates that of EMAS registrations only 18% (less than 600 companies) across the EU are SMEs (EU definition) while in the UK only 25% of ISO 14001 registrations (around 250 companies) are SMEs. By contrast, in Denmark 50% of registered companies have fewer than 100 employees (Hillary, 2000). The Spanish study noted above indicates that environmental management systems are not in use in very small/micro SMEs, the researchers finding no evidence of systems (or for that matter environmental policies) in companies having fewer than 20 staff. This is worrying given that 92.7% of industrial companies in Spain fall within this category.

It is also worth noting the proportion of EMS related to non-industrial organisations. Firm data is only available for EMAS where around 14% of registrations relate to non-industrial organisations including local authorities and supermarkets, Sainsbury's in the UK being one of those taking the lead. The proportion of non-industrial registrations under ISO14001 is thought to be far lower than 14%.

Eco-efficiency

It is also interesting to consider participation in waste minimisation schemes. In the UK for example there are over 50 schemes that have been active recently or are active now. Typically these schemes directly involve 10 to 20 companies (generally small, medium and large rather than micro). Assuming the higher figure as an optimistic average, one can say that these schemes

[5] It is estimated that IPPC will only affect around 30,000 industrial companies across the EU.

have probably assisted around 1,000 companies directly in terms of quite significant eco-efficiency work (see Dee example below). The evidence suggests (e.g. Bichard, 2000) that very few local/regional companies outside these schemes are actually influenced directly by them.

Other evidence of action is available from national programmes. Since its inception in 1994, the Environmental Technology Best Practice Programme (ETBPP) in the UK, which promotes waste minimisation and cleaner technology, typically provides around 300 SME site visits a year to give specific advice, and has probably conducted no more than 2,000 to date. The programme's helpline has received over 100,000 calls and while most of these relate to regulation the programme does widely disseminate information through a series of over 200 publications. The programme is thought to be saving UK companies around £100 million in annual operating costs.

The Cleaner Production Programme 1 (CPP 1) in the Netherlands provided advice to around 9,000 SMEs while CPP 2 has gone on to provide advice to many more. The recent European Commission report on waste prevention and minimisation (Oko Institut, 2000) notes other industrial waste prevention projects in a number of Member States including Belgium, Denmark, Germany, Italy and Spain although the numbers of companies involved are small in each case.

The Dee Waste Minimisation Scheme (UK)

The Dee Catchment Waste Minimisation, launched in April 1995, has involved 13 mainly large companies including British Steel, Rexam (packaging), Kimberley Clark (tissue paper) and Kronospan (chipboard and MDF). As with earlier schemes, the project's achievements are impressive. When it officially concluded in 1997, 282 waste minimisation opportunities had been implemented, saving around 130,000 tonnes of solid waste, 990 tonnes of emissions to air, and 475,000 m^3 of water use. Cost savings totalled £5.75 million a year (2%-4% of the turnover in individual cases), more than 80% of the opportunities having a pay-back period of less than a year.

While it is hard to judge what is happening behind closed doors, it is thought (e.g. Hobbs, 2000) that a very small proportion of companies are actively taking forward eco-efficiency and SD-related initiatives. These are in the main the medium-sized and large companies. A 1995 study on UK waste minimisation schemes (CEST, 1995) found that while 33% of the companies participating in such schemes were SMEs, all had more than 50 employees. The situation does not appear to be uniform across the EU however. A 1997 Dutch survey (VROM, 1997), of SME attitudes and actions in relation to environmental improvement, came up with the findings shown in the box below. The results indicate that SME attitudes to environmental management in the Netherlands are significantly better than in certain other parts of the EU, although of course one cannot determine the degree or value of the improvements being made by the 37% of 'active' companies.

Results of 1997 VROM Survey of SMEs

- 22% inactive
- 41% concerned
- 22% doing something
- 15% see it as part of good business practice

Eco-design and sustainable production

It appears that far fewer companies in the EU are actively involved in the more 'advanced' concepts including eco-design and sustainable production (SP), for example making use of renewable materials. The survey and case study material that exists suggests that in general these companies tend to be medium-sized or large niche players (often multinationals) and that in these companies there is considerable progress. The recent Arthur D. Little survey (ADL, 1998), indicated that 13% of American and 22% of larger European firms were considering or actually implementing quite advanced concepts including eco-design, zero-discharge manufacturing and full-cost accounting. Companies such as Rank Xerox, with their impressive and successful re-manufacturing programmes, and others including IKEA and Ford, are good examples. The JRC report on *Eco-Design: State of the Art in Europe* concludes that in SMEs 'eco-design hardly plays a role' and that the most active parties are actually universities and research institutes (JRC, 2000).

The number of eco-labelled products also provides some evidence in terms of the amount of serious LCA-based eco-design that has been undertaken in recent years. The EU Eco-label, which has been in operation since 1993, involves comprehensive studies of the environmental aspects related to the entire life cycle of proposed products. Unfortunately only 200 products have been certified in the following 15 categories:

- Washing machines
- Refrigerators
- Tissue paper
- Dishwashers
- Soil improvers
- Bed mattresses
- Indoor paints and varnishes
- Footwear
- Textile products
- Personal computers
- Laundry detergents
- Detergents for dishwashers
- Copying paper
- Light bulbs
- Portable computers

It should be noted that 200 products are a tiny fraction of the products on the EU market and that in certain countries, such as the UK, very few of these products are in evidence on the supermarket shelves. A further nine EU eco-labels are being considered, for example in relation to tyres, furniture, vacuum cleaners, televisions, hard floor coverings and even tourist accommodation. The Eco-label Regulation is soon to be revised and will apply to services as well as products. There is also much debate at the EU level about the introduction of an Integrated Product Policy (IPP) approach which would steer environmental policy through a variety of instruments (including eco-labels, producer responsibility, economic instruments, etc.) aimed at products and the supply chain.

In addition to the EU label there are national eco-label schemes in Austria, Germany, Holland, Scandinavia, and Spain. The German Blue Angel scheme is the oldest, having been around for 20 years, and the largest with over 4,000 products now certified. The next largest is the Nordic Swan scheme with over 3,000 products certified under 750 licences. The other schemes are smaller, the Dutch scheme for example having only around 60 certified products, including food products. The UK is looking at a new simplified scheme based on 'best practice' rather than LCA. From the health and safety perspective it is worth noting that the inclusion of relevant parameters is somewhat *ad hoc*, although the Swedish TCO-label for computer monitors is one good example of a label based on health and safety .

It is also worth noting that some companies (e.g. Ford) are providing their own 'eco-declarations', giving eco-information (across a range of key parameters) on their products and manufacturing activities. In the IT sector, Canon and other manufacturers have adopted the NITO (Nordic) eco-declaration system which originated in Sweden, noting that more and more customers, particularly in Austria, Germany, Sweden and Switzerland, are asking for environmental product data. These systems are cheaper than eco-label systems but less rigorous in that they do not involve individual product submissions or independent verification.

In terms of more radical approaches to sustainable production, the Foundation publication, *SME Support Systems for Sustainable Development*, notes a number of national programmes and projects (mainly funding research and development) notably in the Netherlands, Germany and the UK. There is also some private sector activity, particularly amongst the multinationals and larger national companies. Cargill Dow Polymers, for example, is investing heavily in its NatureWorks project to manufacture maize-based polylactide (PLA) as a renewable substitute for current hydrocarbon-based polymers used in textiles and packaging. The plant is expected to be operational in 2001.

Integration and the sustainable workplace

A number of commentators (e.g. Zwetsloot and Bos, 1998) have noted the importance of the integration of occupational health and safety and environment issues in respect of moving companies towards a more sustainable position. It is clear that in several Member States, health, safety and the environment have become increasingly integrated within firms. It is often the case

that companies have one safety, health and environment (SHE) manager dealing with all relevant aspects. This can be of considerable benefit as it allows, for example, all issues surrounding dangerous substances to be dealt with in a co-ordinated way, potentially reducing risks and costs.

In terms of systems, alongside EMS the past decade has witnessed the successful development in enterprises of health and safety management systems which are complementary to traditional regulation. Whereas EMSs have generally been voluntary, occupational safety and health management systems (OSHMS) have to a certain extent been mandatory, e.g. as a result of national implementation of the EU Safety and Health Framework Directive or corresponding national initiatives. Of particular note here are the internal control regulations of Sweden and Norway. Some large companies have developed their own corporate OHS management systems, for example the new IBM Well-Being Management System.

At the formal level there is no link between EMS and OSHMS in the sense that standards or national requirements to implement systems do not refer to the other area. In practice, however, in enterprises themselves there has been a strong tendency to build corresponding and/or integrated SHE management systems (SHEMS), particularly in the Scandinavian countries where it is common. In certain business sectors, it has been decided to set up SHE management systems on a voluntary basis, the European chemical industry 'Responsible Care Programme' being the best-known example.

While good progress has been made in terms of physical health and safety, it is clear that psychological and social problems are becoming increasing significant with many workers having stress-related problems. These issues are clearly more difficult to integrate into formal and physically-based systems, perhaps resting more comfortably with the area of general well-being at work, this including such issues as staff inclusion and development (training, etc.). It is worth noting in this latter context that in the UK there is a standard called Investors in People which requires a systematic approach to staff development.

This takes us on to the subject of employee participation. A recent Danish survey (Danish Confederation of Trade Unions, 1998) indicates that employee participation (i.e. at the non-management level) in environmental management is very poor in all but the Nordic countries. Employee involvement is certainly poor in the UK where all those from middle management down are generally excluded from the decision making and all those from lower management (including shopfloor staff) down are often excluded from the implementation process. This lack of worker involvement can lead to sub-optimal situations, particularly with regard to health and safety considerations (see Annex 1).

It is also worth noting that a significant number of companies, particularly larger companies, are integrating quality management systems with environmental (and in some cases OHS) management systems. This particularly appears to be the case with regard to ISO9001/2 and ISO14001 which in any case have common elements[6]. This is an important and interesting

development as it strengthens the links between the core activities, i.e. production, and the environmental effects.

Monitoring and reporting

It is also interesting to look at the degree to which environmental, health and safety and ethical reporting has been adopted by companies in the EU. In terms of environmental reporting, the number of examples of substantial reports is relatively few (a few thousands rather than tens of thousands), being almost exclusively confined to large companies with high public profiles such as the private utilities and companies such as IBM, Unilever, Volvo, IKEA and British Steel . In the Netherlands, Sweden and Denmark, environmental reporting is now compulsory for those companies that have significant effects. In Denmark, 1,200 companies have to provide an environmental report each year.

The 1999 KPMG survey of environmental reporting (reported in ENDS, 2000) has covered the largest 100 firms in 11 countries, including Belgium, Denmark, Finland, France, Germany, the Netherlands, Norway, Sweden and the UK. This survey has shown that, since 1993, the number of firms producing separate environmental reports has grown from 13% to 24% and that 47% now report in some way on environment. The report notes, however, that quality is variable and that only 18% of the reports are independently verified (although there is no verification standard as such). Interestingly, the report notes that there is a discernible move towards more integrated reporting, especially in the utilities sector. A recent survey of the top 350 UK firms (PIRC, 1999) showed disappointing results in that only 18% produced a separate and substantive environmental report while less than 3% attempted to compare their performance with their peers.

In the absence of more complete reporting, release of indicator data and inventory information is obviously useful. In this context it is worth mentioning the Index of Corporate Environmental Engagement in the UK (Business in the Environment), whereby large companies report on certain aspects of their activities, including ‘unplanned’ emissions, policy, reporting, etc. This year some 426 of the top UK companies have been invited to take part in the self-assessment survey. It is also worth noting the new UK Pollution Inventory for all integrated pollution control facilities, and soon all IPPC sites, which has replaced the older Chemicals Release Inventory. This data is accessible on the Environment Agency’s web site and has allowed Friends of the Earth in the UK to produce ‘league tables’ of polluters.

A similar inventory is produced in the Netherlands and under the IPPC Directive a EU-wide Polluting Emissions Register will soon be developed. As noted: a recent study on the effects of the US Toxic Release Inventory (Hampshire Research Institute, 1998) showed that there had been an overall 17% reduction in emissions in the 300 listed chemicals between 1991 and 1994, suggesting that reporting on toxic chemicals can help to drive such reductions. The survey also

[6] ISO 14001 is to be revised to make it clearer and more compatible with ISO9001.

showed, however, that many companies made false claims, for example by reclassifying recycling as on-site process recovery which is not recorded.

Turning to occupational health and safety, in most Member States some form of reporting is mandatory, generally in relation to the control of hazardous substances, workplace conditions and accidents. Many larger companies, particularly in the chemicals sector, now produce combined health, safety and environment reports. The latest IBM report (1999/2000) for example covers environment and staff 'well-being', the latter dealing with psychological health as well as physical health and safety. In terms of broader sustainable development reporting, it is worth noting that a number of companies are now also adding a social dimension to their reports, good examples being the Co-operative Bank and the Body Shop in the UK and General Motors in the USA, the latter having just released its *Steps to Sustainability* report for 1999/2000.

Chapter 3 The ‘internal’ improvement process

It is clear from Chapter 2 that there is progress, albeit relatively slow, with actions gradually following on from changing perceptions, pressures and motivations. This chapter examines what is involved in the ‘design’ process within organisations and the barriers and success factors that lead to innovation in general and more sustainable production in particular.

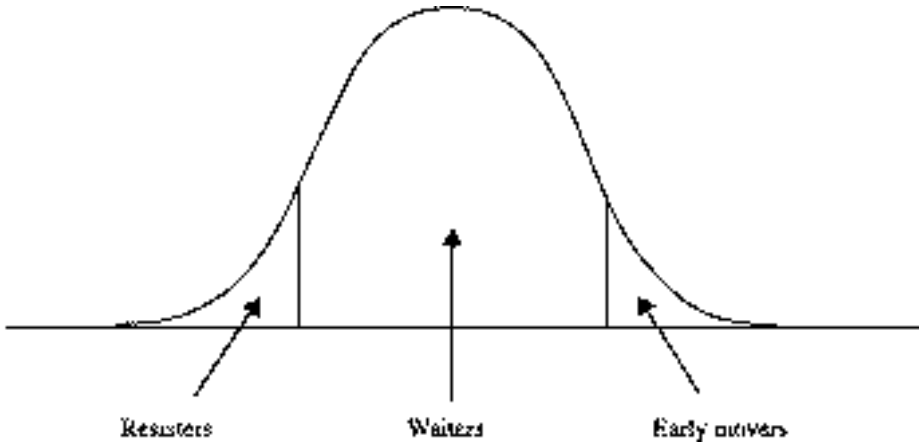
From innovation to mainstream

Several general models have been put forward to describe the stages that companies go through as they progress and innovate. Developing some of the ideas of Anderson (1999), one can postulate that companies essentially fall into one of three groups:

- early movers: fully pro-active companies which look for and take opportunities as they arise, seeing and exploiting the benefits;
- waiters: those that can see some of the benefits of what others are doing but are uncertain about taking steps themselves for various reasons. Hence they ‘wait and see’ what happens;.
- resisters: fully reactive companies which cannot see the benefits of change and/or believe that change is virtually impossible for them.

As already inferred, the early movers tend to be a small proportion of companies, mainly the larger ones, which have the means and motivation to quickly respond to changing circumstances to improve their market position and hence their profitability. The ‘waiters’ are the majority of companies (by definition dominated by SMEs) who react more slowly as various influences come to bear. The ‘resisters’ again are a relatively small proportion of companies which change only in the longer term or when forced to do so, for example when a machine gets worn out, an accident occurs or the company is prosecuted.

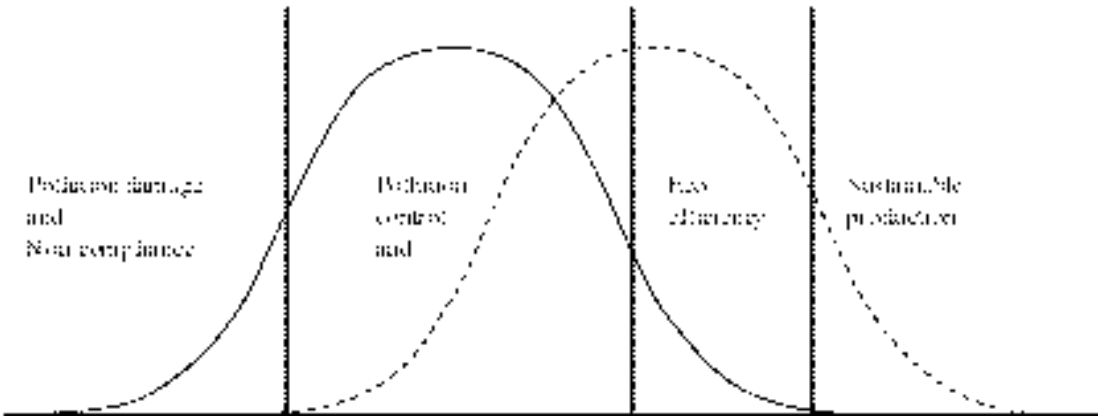
Figure 4 Distribution of company 'types' in relation to innovation



In theory the 'bell' of companies moves slowly towards the goal of sustainable development, each concept becoming more and more mainstream as it becomes familiar. It is, of course, driven by the pressures and motivating factors that we have already talked about, the most important being regulation, cost savings and market conditions.

Figure 5 below shows the current 'hypothetical' state of play with a significant minority of companies having made eco-efficiency and design improvements and only a very tiny minority having reached something approximating truly sustainable working and manufacturing practices. It also shows (dotted) the possible near-future position with the majority of companies having adopted eco-efficiency and design ideas and a very significant proportion having adopted sustainable production ideas.

Figure 5 Progressing towards sustainable development

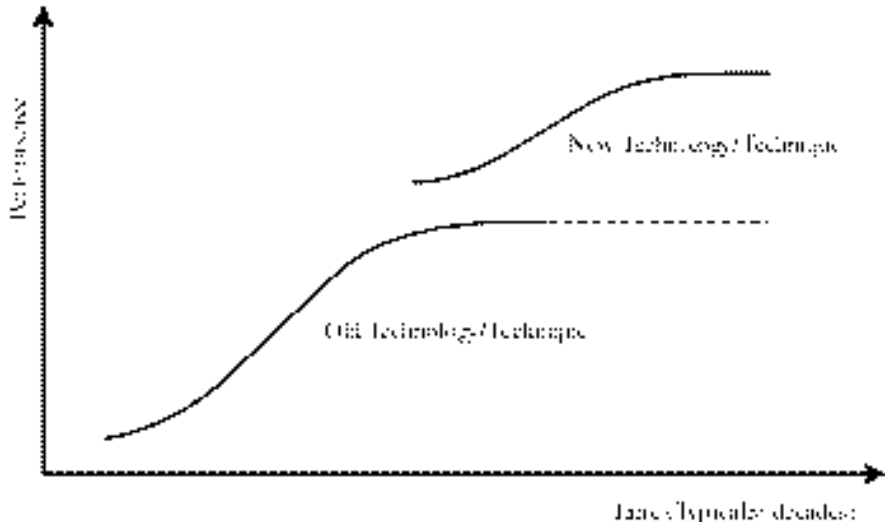


It is clear that the 'early movers' are important as they are innovators, i.e. they can create, develop and exploit new ideas. Understanding the innovation process is therefore important in understanding the processes and success factors that lead to sustainable design of products and processes. Various researchers (e.g. Rothwell and Zegveld, 1985), have considered what is involved in the innovation process and note that it generally involves a coming together of

technological developments and market demand within the bounds of the regulatory and economic framework.

In many cases the innovators see that they are getting into an area of diminishing returns with regard to process and product development and hence look for the ‘step change’ that will take them on to another level of performance. This step change is illustrated below in Figure 6, a good example being the switch from incandescent to fluorescent lighting (Betz, 1993). The innovators make the move and, after perhaps a quite lengthy and costly period of development, start to capture market share through the minority who can see the advantage that it offers and can afford the higher price. Gradually as more units are sold the price drops, market share increases further and the older products/processes are relegated to niches in the market.

Figure 6 Step changes in design



As time progresses there is a diffusion of new technologies and techniques into other organisations, i.e. the ‘waiters’ who gradually take the ideas on and make them more mainstream. In general the overall improvement process, taken over several years or even decades, can be seen as a series of small incremental steps, based on existing processes and products, punctuated by larger bolder steps involving fundamentally new processes and products. Schumpeter (1942), one of the seminal contributors to innovation theory, notes that often periods of rapid growth and restructuring occur when there are synergistic clusters of innovation which stimulate and mutually reinforce each other. He also notes the importance of institutional, organisational and managerial innovation which can facilitate further developments.

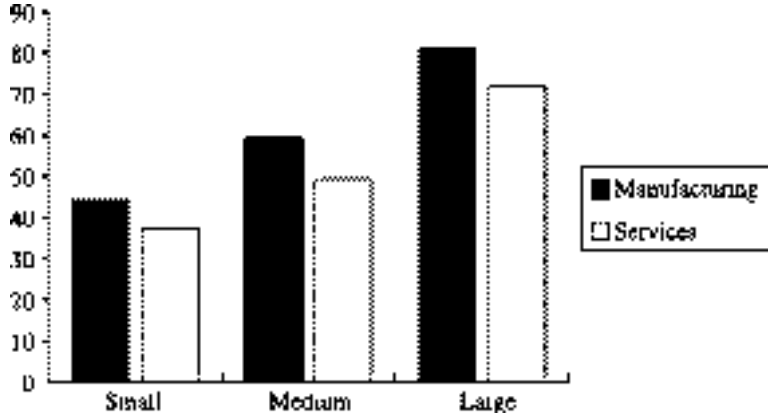
Turning to the concept of eco-innovation, this can be said to be innovation that brings environmental and wider SD benefits, generally, although not always, within an ever tightening policy framework (e.g. stricter legislation and new economic instruments). Meredith and Wolters (1996), through research with manufacturing SMEs in the UK and the Netherlands, note that companies tend to take one of three strategic positions, in relation to SD and eco-improvement, which broadly mirror the categories noted above:

- Innovative (early movers): perceive high threats and high opportunities. See an immediate need to change and do so;
- Offensive (waiters): perceive low threats and high opportunities. Accept the need to change but only in the medium term;
- Defensive (resisters): perceive high threats but low opportunities. Do not see the advantage of change.

This all assumes of course that the commercial opportunities are real. Weaver et al (2000) in their book on the Dutch Sustainable Technology Development (STD) programme, note that there is a potentially serious barrier to eco-innovation in that some of the technologies and techniques that need developing are not commercially viable, in general since all the relative benefits to society are not internalised in the economic system. In some cases, therefore, external incentives have to be provided by governments and other external bodies. Without eco-innovation occurring, however, external intervention in markets is less likely to occur as the policy makers are unaware of the benefits – i.e. a Catch 22 situation. This can lead to the 'lock-out' of new technologies and approaches.

It is also interesting to note the position of SMEs in relation to innovation. Traditionally much of the innovation has come from larger companies which have the means to conduct the R&D and develop and commercialise the original ideas. This can be a time consuming and costly process, not least with regard to the taking out of patents. Smaller companies, which have very limited resources, tend to be very risk-averse and hence are disadvantaged in this respect. The Community Innovation Survey 1997/98 (EUROSTAT, 1999) confirms this view as indicated in Figure 7 below. Interestingly, the difference between small and large companies is less pronounced in Germany and Ireland and more pronounced in Spain, Finland and Luxembourg.

Figure 7 Percentage of innovating enterprises by size



Source: EUROSTAT, 1999.

Whalley (2000) makes some interesting observations about the micro firms and in particular Owner Managed Businesses (OMBs). He claims that most of this group, while often having

some innovative/visionary aspects to them, are largely in the defensive/reactive group, concentrating on survival and maintaining control with little interest in change or growth. While no doubt this is true, small companies do have certain advantages over larger companies due to their streamlined management structure and lack of ‘baggage’, or in other words through:

- lack of bureaucracy;
- good internal communications;
- ability to respond rapidly to change;
- lack of preconceptions and inhibitions.

While far more small innovating companies fail than succeed, many significant innovations have come from individuals, working on their own or within micro firms. A very good illustration of this last point and indeed much of the discussion above, is the process that has led to the creation of the highly successful Dyson vacuum cleaner in the UK as described in the box below.

The Dyson Vacuum Cleaner Story

James Dyson is an English inventor who had an idea for a new vacuum cleaner that did not use bags, but rather a form of ‘cyclone’ which used centrifugal force to trap particles in the base of the cyclone cone. The idea was that this would overcome the loss of suction that occurs on regular vacuum cleaners as the bag pores get increasingly blocked. Having failed to sell the idea to the large international vacuum cleaner manufacturers, who said his ideas would not work, he took out his own patents at great cost and began his own small business, manufacturing the machines in the UK. The new vacuum cleaners, which are produced in bright colours with the dust visible in the transparent cyclone, have now become the best selling vacuum cleaners in the EU. Interestingly the latest machines are more sustainable designs in that they:

- do not need replacement bags;
- use less power than conventional machines (around half in some cases);
- are much quieter than conventional machines, reducing noise nuisance;
- are much lighter than conventional machines, reducing the risk of injury when carrying them.

The traditional manufacturers, including Electrolux, have now brought out similar ‘cyclone’ models so as to compete. The innovation cycle is therefore complete with the technology firmly in the mainstream.

Barriers to improvement

There is now reasonably comprehensive information on the barriers to environmentally related improvements (if not wider SD improvements) in companies, particularly in the more ‘intractable’ SMEs group. Many, although far from all, of these barriers relate to the awareness,

attitude and motivational issues that have already been discussed in Chapter 2. Others relate to such things as company culture and working structures.

In their small firms energy savings survey of 1996, The British Chamber of Commerce (BCC) found that from 423 responses gathered, 60% cited lack of management time, 39% cited lack of knowledge and 37% lack of funds as barriers to improvement. Many others including ourselves (ECOTEC 2000 for the EFILWC), Gerstenfeld and Roberts (2000), Hillary (1999), KPMG (1997) and CEST (1995) have also identified the main internal (company) barriers to environmental improvement and EMS uptake. These barriers and others are highlighted in the box below.

Perhaps not surprisingly the barriers identified tend to be the same irrespective of whether one is considering EMS, waste minimisation, energy efficiency, eco-design, occupational health or perhaps even any form of innovation. Presumably this is because companies are always taking the same internal factors into account when making decisions, primarily in respect of their market share and profitability and hence such commercial business issues as payback on investment, risk, customer perception, etc.

Hillary (2000) and others note that the barriers can be split into key groups, these relating to:

- resources and capabilities;
- awareness and motivation;
- management culture and structures.

It should be noted that the groups are clearly interrelated. Motivation, for example, is driven directly by awareness and perceptions, which in turn are related to having good external links. Resources and capabilities and perhaps to a lesser extent culture and structure can also relate to external links and hence access to best practice information, support, etc. The particular barriers under each heading are noted in the box below and described further in the text that follows.

Key barriers to SD improvements in manufacturing and commercial SMEs

Resources and capabilities

- lack of time/staff resources for investigation and implementation;
- lack of financial resources (mainly capital) for investigation (e.g. pilot) and implementation;
- lack of required technical skills and knowledge (competencies);
- lack of ‘risk-assessment’ competencies;
- lack of investment appraisal competencies.

Awareness and motivation

- lack of awareness/understanding of the problems/issues themselves;

- lack of awareness of better processes/product designs and other potential improvements;
- lack of clear regulatory drivers and awareness of those drivers that exist;
- lack of actual (real) economic incentives in some cases;
- lack of awareness of the true benefits (e.g. cost savings) of improvements;
- lack of awareness of competency/skill needs;
- lack of awareness of available tools and techniques;
- lack of awareness of support and its value.

Management culture and structures

- lack of strategic and holistic thinking;
- lack of goals and targets;
- inadequate cost accounting systems;
- poor attitudes to investment and risk (e.g. economic ‘short termism’);
- inadequate internal company communication and functional integration;
- inadequate external communication, even with customers and suppliers;
- inflexible company culture and resistance to change;
- lack of leadership and management commitment;
- lack of employee involvement.

Resources and capabilities

Time

Resource constraints can be a problem in all companies. However they are clearly the key issue for SMEs, shortages of staff time being the most important. Competitive pressures facing European companies often mean that staff levels have been paired down to the minimum, staff being required to multi-task and work long hours. This is particularly true in the UK where working hours are the longest in the EU and increasing[7].

Clearly the small and micro SMEs simply cannot afford to allocate one member of staff to environmental and SD issues. In many cases there may only be a few (in micro companies only one) trying to cover everything from design and marketing to production and delivery. Inevitably those in these roles have to prioritise and those activities that are considered ‘non-core’ will be at the bottom of the pile. This invariably means that managers never get around to even considering SD-related improvements, unless they are a fallout from improvements being made for other reasons.

[7] The Labour Market Trends review of December 1999 noted that 24.5% of staff in firms of all sizes worked more than 45 hours a week, a 3.1% increase since 1998.

ECOTEC work in Wales for the Welsh Development Agency (ECOTEC, 1998) and the Environmental Technology Best Practice Programme has indicated that in general SMEs do not even have time to regularly read literature that is mailed to them, let alone judge its value. In many cases they are swamped by literature and telephone calls offering advice, free or otherwise. For most, making time for even a one or two-day course or workshop is extremely difficult and can only be justified if the benefits are clear. Even where companies invest time in training and education (e.g. workshops) they often then find it difficult to put the theory into practice, everyday pressures pushing out 'good intentions'.

Finance

In terms of finance, while many SD-related improvements can be made with minimal investment, many improvements require considerable injections of capital. Most EU manufacturing companies now run on relatively tight profit margins and while large companies with high turnovers can still afford to invest large sums on a regular basis, small companies cannot. A company with a turnover of 4 million euro, and making a net profit of 5% (after tax, payment of dividends, etc.), would only have 200,000 euro to reinvest. There will of course be various demands put on this money and only a fraction may be available for cleaner technology for example. In many cases companies are therefore forced to borrow, the cost of borrowing further reducing subsequent profits. Securing loans can in some cases be difficult for small firms with limited assets.

Capabilities

In terms of capabilities, the nine national Foundation studies on *Education and Training for Sustainable Development* have indicated that SMEs would benefit from a range of competencies (skills and knowledge) covering the following areas, these being generalised as follows:

- health, safety and environmental regulation;
- health, safety and environmental impact;
- pollution/waste prevention and control techniques;
- pollution/waste prevention and control technologies;
- eco-sustainable-design and related tools and techniques (e.g. LCA);
- health, safety and environmental management systems;
- investment appraisal techniques.

One can easily add to this list, for example including such areas as:

- design innovation techniques;
- social ethics, particularly in relation to community rights and inclusion;
- human resource skills, in relation to staff development, inclusion and workplace democratisation.

While competencies in each of these areas may be available in larger companies, where staff are able to specialise, they are rarely all present in SMEs. Given that most small and micro SMEs are unable to employ specialists and often have only a few staff with a university education, most would be lucky to have competencies in more than two or three of these areas. For this reason education, training and the provision of external support are critical for SMEs in particular. It should be noted, however, that SMEs are not an homogenous group, each sector and indeed company having different and specific needs.

Awareness and motivation

Chapter 2 highlights many of the awareness, attitudinal and motivational issues that affect company behaviour. It is certainly clear that many companies, especially smaller SMEs, have very limited awareness and understanding in various important respects, i.e. that:

- they may be acting illegally;
- they could improve their performance;
- they would benefit in financial and other ways from doing so.

Perhaps the most important issue is that firms, and small firms in particular, do not realise that they can improve their competitiveness and profitability whilst also becoming more sustainable.

Given adequate support systems (as discussed later) lack of time is the main cause of this poor awareness. Unfortunately, not being aware of these issues effectively puts a stop to any further action. Without understanding that opportunities exist, companies cannot knowingly look for ways of exploiting them. Even where companies are aware of opportunities they may not take the correct steps. As several of the Foundation's recent reports on education and training note, most SMEs neither consider training needs in any sort of systematic way (ECOTEC, 2000) nor take time to examine the support services and tools that are available to them.

As noted earlier, this all presupposes that the threats and opportunities really exist. While this is often the case, there are still many 'incentive' gaps in the policy frameworks and markets in which EU companies operate. Policy and market aspects are obviously important and are addressed further in Chapter 4.

Management culture and structures

Lack of strategic and long-term thinking and investment is clearly a barrier to progress in terms of SD-related improvements and many innovations in general. As various commentators note, this is a particular problem in smaller SMEs who do not tend to deal with management in a strategic fashion (Gerstenfeld and Roberts, 2000). The concept of establishing a long-term vision and then working towards it is completely alien to most SMEs who tend to work from day to day, making only incremental and reactive changes.

As Weaver et al (2000) and others note, the UK and many other parts of Europe are suffering from institutionalised short-termism, which limits investment in anything with a medium to long

term gain, essentially anything with a payback of more than two to three years. Given that the full costs of wasted resources and environmental and social impacts are generally not reflected in actual ('private') costs, improvements (e.g. reduced water use) which primarily bring SD benefits are often seen as unattractive due to their relatively long payback periods. Completely changing production approaches, for example moving away from extracted raw materials to agricultural ones, may take a very long time indeed but may be well worth the effort.

In larger companies this short-term approach to investment is often driven by the need to satisfy shareholders and protect the share price. In smaller companies that do not issue shares to the public, the approach is generally to do with a lack of financial strength, i.e. the ability to bridge cash flow gaps that occur whilst waiting for returns on investments.

Certain types of firm 'culture', particularly in terms of the decision-making structures, can also present particular barriers. These can be crucial in terms of the organisation's potential to change and innovate and in terms of the way that companies can be engaged and influenced by external factors. 'Old' firms with complex and pyramidal hierarchies, where the power rests in the hands of a few senior managers who have been with the firm for decades, may be resistant to new ideas and change. In some cases a reluctance to share power may limit the opportunities for staff involvement (see below).

The functional relationships in firms are also important in terms of furthering SD-related improvements. A lack of communication and coordination between functions (so-called joined-up thinking) within firms can be a major barrier to progressing SD-related initiatives. Eco-efficiency and design projects, for example, should involve many functions within a company, from purchasing and manufacturing through to marketing and of course including health safety and environment. The departments or individuals responsible for these functions have to communicate to make things happen in an integrated way. Zwetsloot and Bos (EFILWC, 1998) note that while environmental experts and managers are increasingly included in the strategic planning and innovation process, health and safety experts are often left out, leading to processes and products that are potentially less than optimal in terms of OHS considerations.

As noted in Chapter 2, worker involvement is often poor in all but the Nordic countries. This is a problem as in many cases those at the lower levels of business have a good knowledge of the process and hence a good idea of what practical improvements should and can be made and want to be involved as it gives them greater job satisfaction. Busck (2000) notes that worker participation is crucial in terms of occupational health and safety, without which health and safety measures are often far from satisfactory.

Internal solutions and success factors

While some of the solutions to the issues noted in the previous section can only be found externally, much can be done within companies to improve process and product 'design'. This is

clearly crucial to corporate well-being, allowing for continuous improvement and innovation in response to market demands and other pressures (e.g. legislative, customer, etc.).

Design can be looked at strategically, in the medium to long term, and in more detail in terms of near-term developments of real processes and products. Empirical studies (e.g. Morone, 1993) have established that the most successful enterprises tend to be those that have both development tracks running side by side, with design for incremental improvement running alongside strategic research and development aimed at more fundamental breakthroughs. Both should fit into a broad continuous improvement process, such as that often advocated for waste minimisation, etc. (ETBPP, 1998).

In terms of products, design for sustainable development has to be about the whole life cycle, taking into account the various stages from raw materials extraction through the manufacturing process to use and final disposal. It therefore involves considering such things as material types and quantities, efficiency of manufacture and use, longevity, ease of dismantling and repair, etc. in the context of reduced resource consumption and emissions. ‘Design’ should therefore involve many functions within a manufacturing company, namely:

- senior management (directors), who set the strategic direction and the design agenda;
- the design engineers themselves, who come up with concepts and take them through the development phase;
- manufacturing systems (production) and maintenance engineers, who have to ensure that new products can be manufactured successfully and new processes made to work reliably;
- those involved in packing, warehousing and distribution of new products;
- sales and marketing staff, who will need to promote the new products;
- health, safety and environment staff who will need to deal with new and altered impacts;
- procurement staff, who may have to source new materials, products and equipment;
- finance staff, who will have to find the money to allow new products and processes to be developed.

The design process can also quite naturally involve key customers, suppliers, shopfloor staff and other stakeholders, although the evidence suggests that this is not often the case. Logically if one is to extend the concept of design to ‘sustainable production’, encompassing wider issues such as the workplace environment and worker involvement, one also has to consider the involvement of personnel departments, works councils and trade unions. The successful SP design process therefore has to be holistic, in that it encompasses all economic, environmental and social considerations within an organisation’s influence in an integrated fashion. It has to look outwards as well as inwards, an issue covered further below.

Design for sustainable development is perhaps only different from ‘regular’ design processes in that it adds an extra dimension and increases the complexity of the process, organisations having to push the boundaries so much harder to make progress. It is interesting to note that in terms of

eco-innovation, van Dijken et al (1998) indicate that the three key inter-related pillars on which companies should build are:

- strategic orientation;
- business competence;
- network involvement.

These areas relate directly to the barriers to sustainable development already noted and are discussed further below along with some of the other key issue surrounding successful 'design' processes.

Strategic design

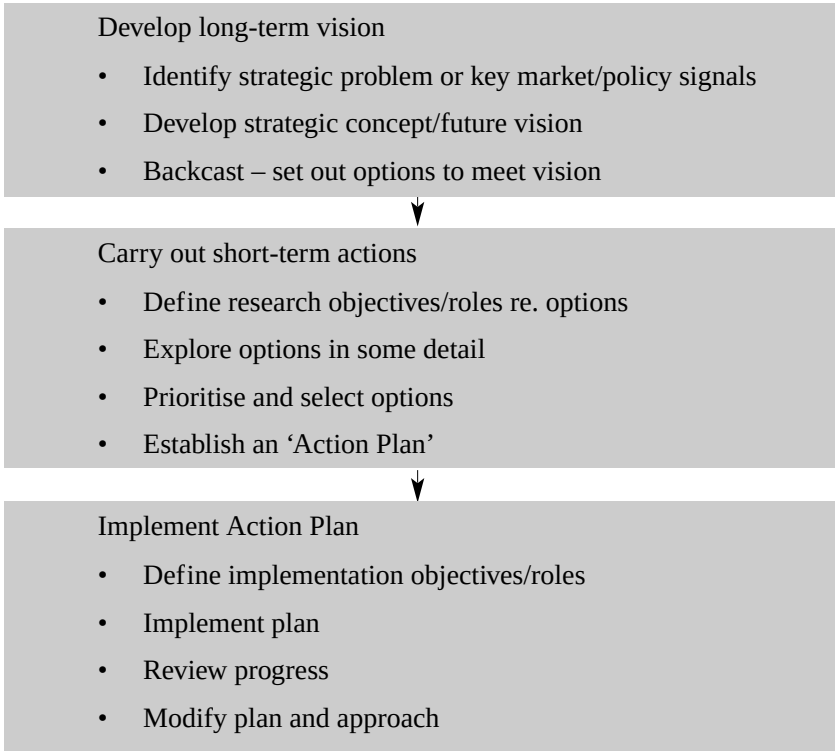
The 'normal' design process takes place incrementally and with only short-term objectives, in general being related to existing products and processes. Most innovation occurs through response to market and policy signals. Hunter (2000 – ETBPP presentation on eco-design) notes that the key drivers that companies should look out for in eco-product design are:

- new and proposed legislation and policy;
- greener customer/consumer requirements as identified by market research;
- market opportunities in terms of brand enhancement and new niches;
- opportunities for cost savings, i.e. getting more from less.

This is a valuable approach. It is reactive and relatively short term, however. Design for sustainable development should also be about meeting a longer-term vision, without clear policy and market signals. This is something that requires particular competencies to be brought to bear in a clear operational framework. In the latter regard the form of step-by-step approach suggested by Weaver et al (2000) and others including Meredith (2000), seems to make an admirable model for all such long-term 'design' thinking. Such a model is set out in Figure 8 below.

The concept of 'backcasting' is important as a way of developing a vision for future technologies and techniques. Essentially backcasting involves envisaging the end point (or points) that one is trying to reach, for example 50% of all polymers to be made from renewable agricultural crops in ten years, and then working back to establish what must be done now (or in the near future) to achieve that. Backcasting offers what some refer to as a 'blue sky' approach to the design process, i.e. one that is not constrained by the existing technologies and techniques, and therefore hopefully offers a better chance of identifying breakthrough developments.

Figure 8 The strategic design/planning process



The approach has been used for many years in the aerospace industry where product development takes place over long timescales (e.g. ten years or more) and hence requires careful consideration of what future scenarios and needs may exist to be met. A more down-to-earth example of backcasting, with an eco-design and social equity flavour, is given in the box below.

Trevor Baylis and the clockwork radio

Trevor Baylis, the English inventor, saw the need for greater access to public service (e.g. health) information in Africa and other developing countries. He had a clear vision of a radio that would work well in such countries without any need for batteries or mains power. There were several options including the use of solar power: however having investigated each Bayliss came up with a clockwork mechanism that merely needs winding up. This and other clockwork products are now in use in many developing and developed countries, as appropriate technology in the former and fashion items in the latter.

Holmberg et al (2000) of the Natural Step Foundation suggest an alternative four step 'backcasting' process for those wishing to produce more sustainable products and services:

1. Define sustainable development criteria;
2. Assess the present processes and products in relation to the SD criteria;
3. Envision and consider options that will meet this criteria;
4. Identify appropriate strategies and objectives that will allow progress towards the sustainable options.

Holmberg et al (2000) note the importance of using sustainability criteria (or principles) and related indicators in an integrated way so as to ensure that one problem is not solved only by creating another, so-called 'impact-displacement'. These criteria can be used where necessary to guide more detailed investigations, for example using checklists and life cycle assessment methodologies. Importantly, Holmberg et al also note the need to think clearly about the objective of what is being attempted rather than current means. For example, a car manufacturer may wish to think of itself as a mobility provider (i.e. a service) rather than just a provider of goods. This sort of 'thinking out of the box' can open up numerous new possibilities.

Operational design

Having defined 'objectives' within the strategic plan, one can consider what might be called the operational 'design' phase. According to Pahl and Beitz (1996), the design of the process or product moves from a set of strategic concepts, through preliminary designs with defined shapes and materials, etc. to a final detailed design with drawings, etc. As with the more strategic process, sustainability criteria and other tools (design for environment, design for disassembly, etc.) can be used at the conceptual and preliminary stages.

With regard to product design, Hunter (2000) notes the need to think carefully and separately about form (i.e. the object itself and what goes into its manufacture) and function (i.e. the object in use) as indicated below in Figure 9. It is worth noting that, where possible, the health and safety aspects of products should also be taken explicitely into account where possible.

Figure 9 Eco- product design – form and function

Cleaner form

Less material, energy, water to produce;

Fewer hazardous production substances;

More cleanly-produced materials;

More reused and recycled components and materials;

Easier to reuse, disassemble, recycle.

Cleaner function

Less material, energy, water in usage;

More function for less product;

Fewer harmful emissions;

Longer service life;

Lower disposal impact.

But how does eco-design integrate successfully into product development? Environmental issues have to be dealt with from the outset within the various business functions that deal with product and specification development. Product impacts should, as a matter of course, be considered alongside other design parameters such as fitness for purpose (technical performance), marketability and cost.

But how should these impacts be assessed? In the ideal world each product and process would be assessed and modified in accordance with a full LCA taking into account all SD-related parameters. Clearly this is not a realistic option for most SMEs. Although IT-based tools can help

in this regard, they often need considerable amounts of data which may not be readily available. We have to accept therefore that for many companies a cruder assessment may be all that is achievable, perhaps making use of generic impact data in relation to materials, types of components, key processes, etc. for a range of indicators. More simply, a set of principles can be used.

In terms of the broader issues surrounding integrated eco-design, the success factors are mostly the same as those that apply in the case of waste minimisation. In his thorough review *Success Factors for the Integration of Eco-Design in Product Development*, Johansson (2000) identifies six main areas of concern as shown below in Table 3. Some of these issues are discussed further below.

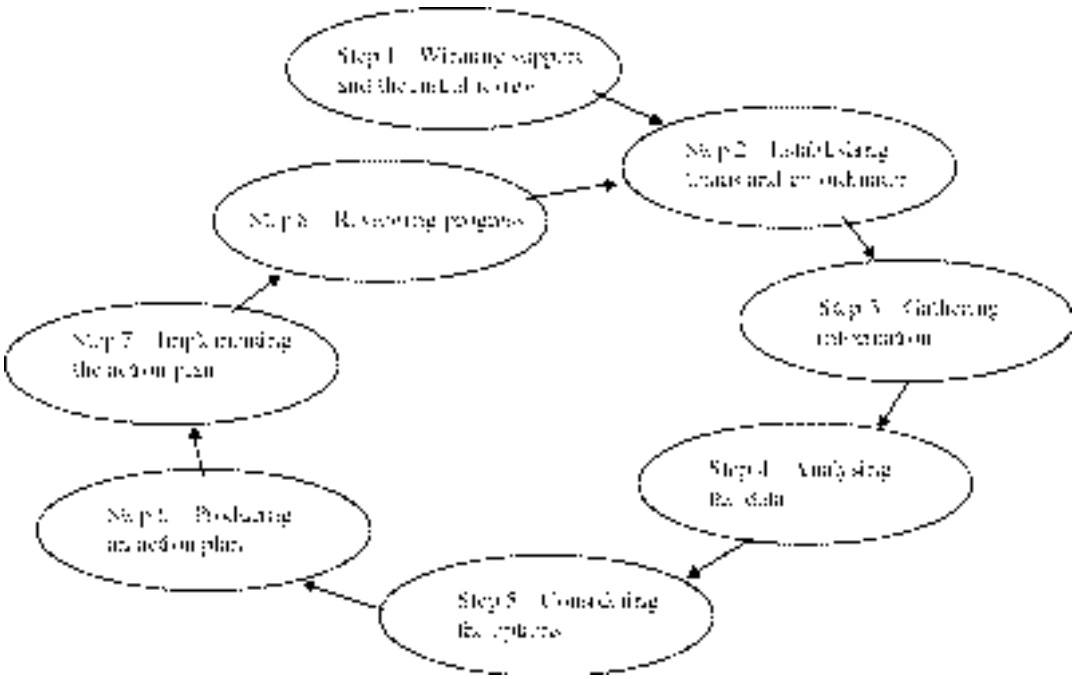
Table 3 Success factors for integration of ecodesign in product development

Area of concern	Success factors
Management	◆ Commitment and support are provided ◆ Clear environmental goals are established ◆ Environmental issues are addressed as business issues ◆ Ecodesign issues are treated on a strategic and operational level ◆ Eco-issues are included in the company’s technology strategy
Customer relationships	◆ A strong customer focus is adopted ◆ Companies train their customers in environmental issues
Supplier relationships	◆ Close supplier relationships are established
Development process	◆ Environmental issues are considered at the very beginning and integrated into the product development process ◆ Eco-reviews/milestones are introduced into the development process ◆ Company-specific eco-design principles, rules and standards are used ◆ Ecodesign is performed in cross-functional teams ◆ Support tools are applied
Competence	◆ Education and training are provided to the development personnel ◆ An environmental expert supports the development activities ◆ Examples (case studies) of good design solutions are utilised
Motivation	◆ A new ‘environmental’ mindset/culture is established ◆ An environmental ‘champion’ exists ◆ Individuals are encouraged to take an active part

Management systems and continuous improvement

Management systems, such as the ISO 9000 series, ISO14001 and EMAS and OHS systems offer a 'good practice' framework, a 'recipe' that allows companies to make continuous and steady progress without the need to make mistakes and waste time and effort. As well as these 'standards', other 'models' have also been developed for companies wishing to take a continuous improvement approach, for example in relation to eco-efficiency, Figure 10 below being one such model (making use of the Deming cycle), while total quality management (TQM) approaches offer an approach to continuous quality improvement. Tools such as checklists, brainstorming and cause-effect diagrams can all be used as part of the process.

Figure 10 Continuous eco-efficiency improvement model



Source: ECOTEC/ETBPP

While most of this is self-explanatory, it is worth picking out a few particular points that relate to some of the sustainable development barriers noted earlier.

Data gathering and analysis

When getting down to implementing strategic ideas, very little can be done without hard data from which to make judgements and develop solutions. In manufacturing terms, without monitoring there can be no control. While this seems obvious, eco-efficiency support projects show time and time again that most firms, including the larger and well-known ones, know little about their own impacts, and in particular resource use and wastage. Often companies do not even have their processes 'in control' in terms of manufacturing products within defined quality limits. The systematic monitoring of key parameters or indicators, and the analysis of this data, is

crucial to the proper sustainable management of companies. This principle applies to all aspects of the business, covering everything from raw material use and product quality to workplace air quality and accidents. While this monitoring and analysis takes time, it allows:

- comparison between processes on a site;
- comparison between sites and companies (benchmarking) where ‘external’ data is available;
- costs and benefits of options to be assessed and choices made;
- progress over time to be tracked and reported on in a consistent manner.

This has to be done carefully however. Measuring water use, for example, is of limited use unless related to production, i.e. one has to talk about ‘specific’ measures, in this case the number of cubic metres of water used per tonne of product produced, for example. Indicators therefore have to be carefully designed. It is worth noting that the new ISO14031 standard brings a systematic approach to environmental performance evaluation (EPE) if not to other related areas.

Management commitment

As noted earlier, many companies have a pyramidal hierarchy with most of the power in the hands of a few. In these circumstances unless a strong justification can be made to senior managers in cost/competitiveness terms, improvement prospects will inevitably be very poor. Gaining management commitment is in fact perhaps the single most important success factor, noted by many commentators (e.g. CEST, 1995, Johansson, 2000). It is clear that in these circumstances those wishing to progress improvement measures must endeavour to find proper evidence rather than mere supposition.

While some measures can be low cost or no cost, most require significant investment. Unfortunately investment appraisal of new processes and products often only takes into account the obvious and direct costs and benefits. In terms of waste, for example, most SMEs only think of disposal costs even though the related material, water, energy and labour costs associated with producing that waste are often at least ten times the disposal cost itself. Other indirect and longer-term cost and benefits, for example relating to such factors as product quality, market profile, staff morale and retention, etc. can be equally important. This problem of course relates back to poor awareness and lack of time and competency, all of which must be overcome through a combination of internal and external actions as discussed further below.

Integration and involvement

It is clear from the earlier discussion that ‘design’ logically requires a cross-functional approach to make single-topic projects more effective and to allow multi-topic SD issues to be addressed properly. For large, medium and even small companies, establishing an improvement team or teams to carry forward different aspects of a strategy is often the best way forward. This has certainly been shown to be the case in terms of eco-efficiency work (ETBPP, 1998, CEST, 1995), although success often relies on the team being lead by a motivated co-ordinator or ‘champion’. Eco-efficiency experience has shown that, in the UK at least, such champions should:

- have a strong interest and belief in the 'cause';
- have a good understanding of the production and 'design' process;
- should have access to key decision-makers;
- should be given appropriate resources (time, staff, money) to investigate potential improvement measures.

Where teams are used they should not just involve managers, however. As noted earlier, shopfloor employees are often the ones who really understand production and equipment problems, etc. and hence are often well placed to inform decisions. Recent survey work by the Policy Studies Institute in the UK (source, EFILWC, 2000) has shown that "small firms perform better when they involve employees in the business through direct communication and consultation". In terms of waste minimisation, CEST (1995) have noted the importance of 'operator involvement backed by immediate and visible management action'. Younger firms and those with simpler, 'flatter' and democratic management structures should in theory allow better employee involvement, and partly as a consequence be better placed to innovate and react to change.

The recent working conditions survey by the Foundation has shown that, in general, consultation and participation are actually worst amongst micro firms although often as good in small firms as medium-sized firms. Teamworking is also less common in small and micro firms than in larger ones. This may all relate to the fact that the owner manager of the typical micro firm wants to, and can, physically retain full control, while in larger firms it becomes impossible, delegation and teamworking at least being inevitable. In terms of micro firms, it may in any case make little sense to have a team of three or four working apart in a company that only employs six or seven. The fact that smaller SMEs have multitasking managers in any case reduces the need for teams.

While the consultation and participation problem is difficult to solve in micro firms, small and medium firms should certainly be making use of such mechanisms as issue-focused improvement teams and more general works councils and committees. Where such approaches are taken it is important to give feedback on progress, for example through team briefings, newsletters, etc. Often it is best to do the cheaper and simpler things first so as to gain momentum and motivate those involved.

It is also worth noting that company suggestion and incentive schemes can be used effectively to involve staff and improve the approaches and measures taken. Such schemes are useful, for example, in waste minimisation work and are even used in the OSH field. The Foundation's synthesis report on *Economic Instruments for Sustainable Development* notes, for example, that one Irish chemicals company uses a bonus scheme to encourage improved health and safety standards, the money being recouped through reduced downtime.

Culture change at MacDermid Canning

In some cases it takes a company culture change and/or reorganisation to allow the innovations that are necessary to make any meaningful progress. At one UK speciality chemicals company, MacDermid Canning, very old buildings and poor equipment and working practices led to high losses of product and water, variable product quality and a very poor working environment.

The work of one eco-efficiency 'champion', assisted by a small team and the involvement of shopfloor staff, made the company directors aware of the need for change, a water audit in 1996 being perhaps the key factor. Over a period of only four years the old manufacturing facilities were scrapped and state-of-the-art zero-discharge facilities designed (in house) and introduced. The move to clean technologies has saved the company over £220,000 a year and has had the additional benefit of improving working conditions enormously, hence helping to improve staff morale and health and safety. Environmental training, seen as a waste of time previously, has now been introduced for all team leaders on the shopfloor. The site is now accredited to ISO14001.

Source : ETBPP (2000)

Education and training

Attitudes to education and training are also crucial to a company's ability to innovate and grow. Lack of awareness and competency is often related to failures in terms of 'needs analysis' and hence inappropriate recruitment and staff development. The solution here seems to relate to taking a strategic and outward-looking view combined with a systematic approach to staff recruitment and development, if necessary using a formal system. IKEA offers a good example in that it takes its entire staff through an eco-efficiency/design course using The Natural Step approach as its basis.

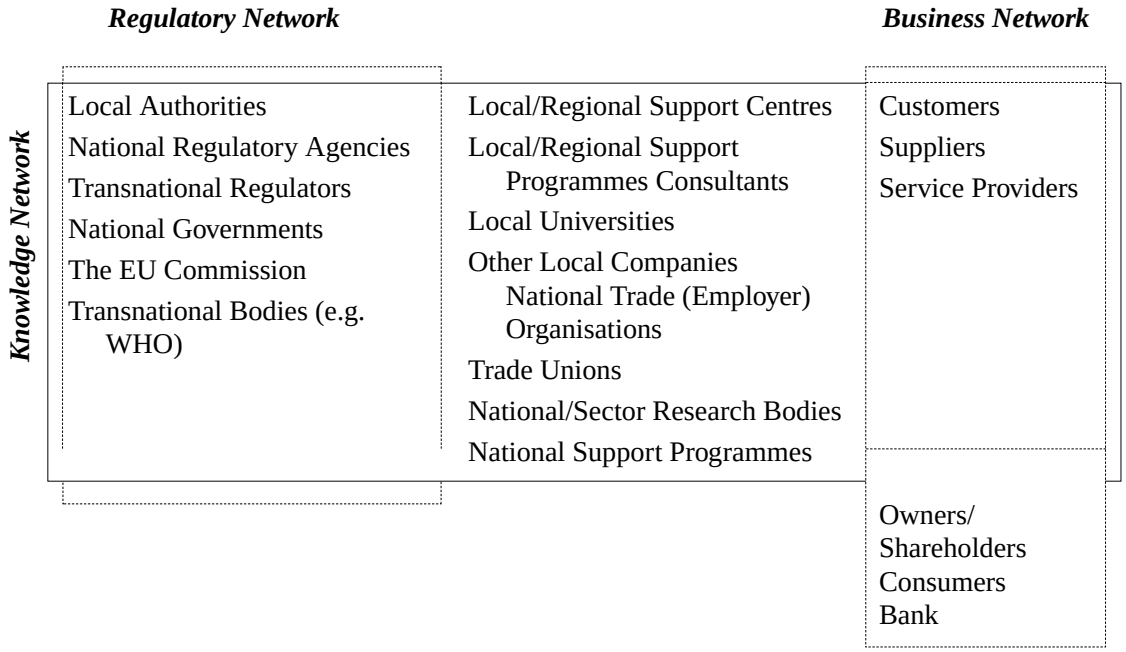
In this day and age companies cannot afford to take an isolationist stance if they are to survive and develop. They have to look outwards to monitor market and societal signals, understand regulation, identify new ideas, technologies and approaches, become aware of tools and external support, etc. Hansen et al (1998) notes three different but interrelated networks that enhance an SME's ability to achieve eco-innovation, these being the:

- business network;
- knowledge network;
- regulatory network.

The various organisations within these networks are shown below in Figure 11. Clearly the range of 'knowledge' (competency and support) opportunities are vast and potentially overwhelming, particularly for a small company that does not really understand its needs in the first place! The degree to which regulatory bodies are part of the 'knowledge network' varies from country to

country and is something of a contentious issue. Can and should the regulator offer help as well as threaten punishment? This is discussed further in a later section.

Figure 11 Businesses and networks



Chapter 4 External pressures and incentives

As noted in Chapters 1 and 2, companies need clear motivations and signals if they are to change their behaviour in favour of more sustainable development. The most powerful motivators remain legislative compliance and competitive advantage in the market place. This section looks briefly at how policy instruments and market pressures can best improve company behaviour.

Regulation

Regulation is normally associated with set standards and limits that can clearly provide strong motivations if properly enforced and associated with clear and powerful sanctions such as heavy fines (way in excess of the potential gains from avoiding the regulation) or even custodial sentences. Regulation can also be used, however, to provide ongoing incentives. Where permits and licences are used, adoption of 'good practice' or an EMS can be rewarded through reduced levels of bureaucracy, for example less regular inspections and simpler lincence renewal procedures. A 'lighter touch' approach, with regard to certain companies with an accredited EMS, is now being piloted by the UK Environment Agency.

One can also provide incentives through the use of differential regulation charges, for example in terms of permit costs. To give an example, water abstraction licences (for rivers,, etc.) can be banded so as to impose exponentially increasing costs with higher rates of abstraction (up to a defined limit), hence encouraging reduced use. In this way regulatory instruments can combine with economic instruments in a form of hybrid control. Some further examples are given below with a following section concerning economic instruments.

Environment

As noted already, much of the EU's early regulation in the field of environment was of the 'command and control' form dealing primarily with the abatement and clean up of pollution. It is fair to say that much of this early regulation led to significant compliance expenditure by industry (typically around 1% of turnover) and the view that environmental improvement was associated with 'costs' rather than any 'benefits'[8]. The 1980s brought a sea change in approach, for example through key EU principles such as the Polluter Pays Principle, the Precautionary Principle and the Principle of Preventative Action.

As a result of this EU action and pressure from certain 'green' Member States, the late 1980s and 1990s heralded a shift to more preventative and integrated regulation that addresses eco-efficiency and eco-design as well as 'end-of-pipe' control. Recent examples here have included the Packaging and Packaging Waste Directive, the IPPC Directive and the Industrial Solvents Directive. The Packaging Directive is a good example of how regulation can encourage preventative improvements as noted in the box below.

Packaging Regulation

The Packaging Directive has introduced a number of features that have required preventative action. The essential requirements of the directive, for example, require minimum material use and packaging volume and design for reuse and recyclability whilst also setting limits on heavy metals use in materials. National recycling and recovery targets have driven Member States to adopt producer responsibility systems of one form or another which, while primarily aimed at meeting recovery targets, have also rewarded minimisation and the change to less damaging designs through the use of charges and other economic incentives.

The Producer Responsibility Obligations (Packaging Waste) Regulations in the UK impose obligations on companies as a function of the type and weight of packaging passed on down the 'chain'. In simple terms, the more they pass on the more they pay for recovery of that material, the regulations making use of economic instruments (see below). Companies also have to provide weight data on their packaging. While many companies have complained about the burden this imposes, it has caused many companies to re-examine how they use packaging in detail. Many have found that they have been able to reduce consumption considerably, often saving large sums of money in the process (ETBPP, 1998). These data requirements have also stimulated supply chain interactions that had been previously very limited outside the usual purchasing/sales context.

Other Member State packaging systems have also had this incentivising effect. The DSD system in Germany, for example, sets very high charges in relation to expanded polystyrene, hence providing an incentive to use alternatives such as cardboard which can provide perfectly adequate protection for most goods, including electrical and electronic equipment.

[8] The fact that industry had been using the environment as a free dumping ground without having to make any contribution to the true social cost of its actions was little understood or accepted by those in industry.

The IPPC Directive also requires consideration of prevention rather than just control. One of the first directives to follow that particular one is the Industrial Solvents Directive that allows for solvent reduction approaches whereby companies can be compliant through reducing the quantity of solvent they use per unit of product manufactured. This is in contrast with older command and control systems that relate only to VOC concentrations in 'stack' emissions and generally required end-of-pipe abatement technologies. This newer type of system has been in use in some UK sectors for a few years now, providing an incentive to reduce the use of solvent-based materials through minimisation and substitution. In the shoe sector, for example, this approach has led to the development and use of water-based adhesives and finishes that have reduced VOC emissions dramatically, significantly improving the internal working environment as well as the external environment whilst saving the sector substantial amounts of money.

Returning to 'producer responsibility', it is clear that there is scope for far more of this type of regulation. The End of Life (ELV) Vehicles Directive and the Waste Electrical and Electronics Equipment (WEEE) Directive, both of which have serious eco-design implications, herald the start of further developments in this area. It is also encouraging to see that the European Commission is developing its thinking with regard to an Integrated Product Policy (IPP) which will in time bring more product-oriented instruments of various kinds (see box below). The first of these is the proposed Electrical and Electronic Equipment (EEE) Directive which sets out non-mandatory eco-design principles.

While regulations can set out principles and certain key targets for product design, one has to note that standards have to play a key role, as hopefully they will with regard to the EEE directive. CEN and ISO standards should have environmental experts as well as technical experts advising on appropriate requirements, making use of LCA and other tools as appropriate. This has been the case with the essential requirements aspects of the Packaging and Packaging Waste Directive but the principle should apply to all products. At the very least it is important that environmentally beneficial aspects are not unnecessarily prohibited or inhibited by standards as has been the case with regard to the use of recycled materials in some products.

IPP developments

While the IPP Green Paper has yet to be completed it appears that the main focus will be on win-win approaches to encourage participation. Instruments will deal with supply-side issues, such as product standards and eco-design initiatives, demand-side/information issues, such as eco-labelling, eco-declarations, etc. and market mechanisms such as economic instruments and further producer responsibility legislation.

Occupational health and safety

Turning to occupational health and safety, there has been strict regulation in terms of accident prevention for far longer than environmental considerations have been taken into account. The Foundation's report *Environmental Management and Safety and Health* (Zwetsloot and Bos, 1998), however, notes that much of this protection has been 'bolt-on', dealing with hazard

assessment, containment, safety equipment and clothing, monitoring, training, etc., rather than through eliminating or reducing the inherent risk present in chemicals and processes.

It is perhaps surprising that hazardous substance regulation, for example, has in recent decades been driven as much by external environment considerations as by working environment ones. For example, the banning of chlorinated solvents under the Montreal Protocol was done to reduce stratospheric ozone depletion rather than for health and safety reasons although such chemicals are hazardous to health. Busk (2000) notes that this is perhaps because the external environment is seen as a problem for society as a whole whereas occupational health and safety is more in the realm of the social partners.

Whatever the reason for it, as Zwetsloot and Bos note, there is certainly a greater need to make processes and products inherently safer through the use of less hazardous materials, lower pressures and temperatures, etc. It is interesting to note that in the USA, the labour inspectorate is investigating a policy to foster inherent safety improvements after accidents have taken place. While this might be considered as 'closing the gate after the horse has bolted', the idea is that the company in question is allowed to invest in new, inherently safer, technology as an alternative to facing prosecution.

It is worth noting that environmental and OHS measures and technologies are often not compatible. To give some examples, the introduction of high-pressure spraying equipment to reduce water use introduces a potential OHS risk. Conversely, improving ventilation can, for example, increase energy usage. To reduce conflict it is therefore important to deal with health safety and environment matters in a more integrated fashion. Integrated regulations and tools such as integrated HSE technology databases can help. The example from the Italian ceramics industry in the box below provides an example of the former.

HSE Initiatives in the Italian Ceramics Sector

About 80% of Italian tile production comes from 188 firms operating in the 50 kilometre^2 district of Sassuolo-Scandiano. In 1998, 85% of these firms employed less than 200 staff. In the 1960s, environmental and health concerns were related to the use of lead in the glaze, the dispersal of silica powder and indoor noise. This situation has improved since then through a mixture of regulation which occurred in an incremental way, sometimes with the close cooperation of the firms. The firms themselves established a cooperative and flexible network spreading good practice. Concrete measures included building of a distinct water supply for firms separate from drinking water wells, establishing an air quality monitoring system, acting as a first mover in terms of acceptable thresholds for air pollutants and drawing up a manual for accident prevention.

Economic instruments

The Foundation's report on *Economic Instruments for Sustainable Development* notes that during the 1980s and 1990s there was an increased use of economic instruments (EIs) which are replacing regulatory coercion with incentives that encourage firms to change their behaviour in a particular direction. In most circumstances the costs to the economy of making the change are lower with economic instruments than under a command and control system, as in theory the market is a more efficient mechanism for achieving the desired result. The EU endorses the use of economic instruments in the field of environmental protection. Its fifth Environmental Action Plan states: "In order to get prices right and to create market-based incentives for environmentally-friendly economic behaviour, the use of economic and fiscal instruments will have to constitute an increasingly important part of the overall approach."

Essentially EIs can include such instruments as charges and taxes, tradable permits, deposit-refund systems, subsidies (on activities to be encouraged) and assignment of liability (to allow the recovery of compensation, for example). The selection and design of taxes is clearly important and ideally should be designed to consider (OECD and others):

- environmental effectiveness – instrument should be designed to meet an environmental objective;
- economic efficiency – instrument should achieve the objective at overall minimum cost;
- equity – who wins and who loses? Can effects be mitigated through other policies?
- acceptability – is the instrument politically and morally acceptable?
- administrative feasibility and costs – is the system cheap to run and free of loopholes?
- revenue raising – what will the revenue be used for? Will it be hypothecated into spending on environmental improvement, lead to reduction of other taxes or increase the general tax revenue?
- compatibility with existing legislation and trade rules – does the instrument impact on trade rules or affect competition in the market?

In terms of effectiveness, some argue that EIs need to reflect actual external costs while others take the more pragmatic view that a level should be set and then altered to ensure that the objective is reached. EI design also has to consider such issues as market elasticity and the scope for substitution for example in terms of materials, services, etc. In terms of equity it is worth saying that the Polluter Pays Principle suggests that taxes, charges and tradable permits are preferable to subsidies. This is because the cost falls on the public purse in the case of subsidies. Some comments on these points follow.

The environment [9]

Eco-charges, taxes and subsidies are now common across the European Union although tradable permits and deposit-refunds are found less regularly (e.g. in the UK, Germany and Denmark). Examples include fuel taxes (all Member States), landfill taxes (e.g. the UK, Denmark, Italy and Germany), tax allowances on clean technology investment (e.g. the Netherlands), product taxes (e.g. Belgian and Denmark), reduced VAT on energy-efficiency products and subsidies for energy from renewable sources (e.g. NFFO in the UK). Two examples are given in the boxes below, both from northern Europe.

It appears that the southern Member States, in particular Greece, Spain and Portugal, are somewhat behind in the application of EIs. According to a recent OECD report, *Analysis of Environmental Results; Spain (1997)*, only 6% of the environmental expenditure of the central government has been funded through environmental taxes and levies. At the regional and local level, the figures go up to 14.6% and 27%, respectively. Costs of environmental goods (e.g. water), therefore, do not even come near to reflecting the true 'private' cost let alone the wider social costs that remain external to the economic system.

The UK Landfill Tax

The UK Landfill Tax was introduced in 1997 to help increase the cost of landfill and hence make alternatives including incineration and recycling more attractive options. The tax was set at a level (£7/tonne for non-inert waste, £2/tonne for inert waste) which aimed to reflect the difference in external costs between landfill and incineration. The tax has been revenue neutral, the monies raised being used to provide funds for good environmental causes and to reduce the cost of national insurance payments and hence the cost of employment. In 1999 the tax was raised to £10 per tonne with an escalating scale of £1 per year being applied to take the tax to £15 by 2004 check.

In terms of impact, work by ECOTEC (EFILWC, 1997) has indicated that the tax, even at the lower £7 rate, had an impact on producers making them more aware of their wastage. Other effects were perhaps more unexpected. For example waste management companies began charging more for commercial and industrial waste collection, using the tax as a justification, but then made efforts to recover materials to sell for recycling, hence avoiding paying the tax and maximising profits. In this way the 'polluter' was helping to subsidise recycling as intended. The story is also interesting in terms of inert waste. Here an ECOTEC study (DETR, 1999) estimated that the tax had led to the diversion of a very significant proportion of mainly construction and demolition waste from landfill, although much of this has thought to have gone illegally into exempt activities of dubious merit, such as golf course construction and farm road 'improvements', and fly tipping. It is thought, however, that recycling activities have increased significantly.

[9] For further information see the European Foundation's *Consolidated Report on Economic Instruments.*

Nickel cadmium battery taxes in Denmark

Inappropriate disposal of nickel cadmium batteries is a major source of cadmium in the environment. The increased use of rechargeable batteries (which use NiCd cells) exacerbates this. Danish municipalities had provided facilities for separate safe disposal of batteries for some time, however only about 20% of batteries were disposed off through this route. In 1991 an agreement was reached between the government and the Association for the Collection of Rechargeable Batteries which introduced a fee on new batteries. Retailers were obliged to establish systems for collection of used batteries. The number of batteries recovered rose to 35% of those sold. Only about half the retailers installed collection boxes. In 1995 a new eco-tax on NiCd batteries was introduced raising the price of the NiCd batteries to a third above the alternative. Part of the proceeds of this tax is returned to collectors of used batteries who are paid $17.6 per kilogramme for collected batteries. The change in policy has caused a substantial switch to the less polluting nickel-hydride and lithium based batteries. There has also been a substantial rise in the proportion of batteries recovered.

In general one can say that the impact that EIs have on achieving the desired environmental objective is positive. Relatively small differential taxes (10% to 15%) in relation to leaded and unleaded petrol, for example, have been successful in encouraging a switch to the latter, although the ban on leaded petrol in 2000 (now imposed) must also have had an impact on behaviour. Clearly high tax rates are needed where demand is inelastic. In the Netherlands, the tax on wastewater discharges to surface waters has been high enough to encourage effective on-site treatment. Swedish NOx taxes also offer an interesting example of a motivating tax. In 1992 Sweden introduced a charge on NOx emissions from large combustion plant based on emissions. Taxes raised are redistributed to the same energy producers based on their efficiency of production with some producers net winners and some net losers. The approach has encouraged both a reduction in NOx (35% within one year) and an increase in energy efficiency.

It is worth noting that the UK Packaging Regulations have effectively introduced a system of tradable permits. Obligated companies under the regulations are strongly encouraged to obtain Packaging Recovery Notes (PRNs) from accredited reprocessors as evidence of compliance, these PRNs being sold on the open market (per tonne of material reprocessed). The revenue obtained by the reprocessors from PRN sales is meant to be reinvested to allow improved collection, increased reprocessing capacity and greater use of recycled materials in products. Problems have arisen, however, as some materials (particularly plastics) have been exported in quite large volumes (e.g. to the Far East) while some UK reprocessors are thought not to have reinvested as they should, being accused of profiteering. The regulations are being tightened to deal with these and other ‘design problems’.

Quite different forms of tax-related inducements can also be effective. In Belgium, where the regional authorities are responsible for granting subsidies to firms investing in environmental technologies and research, some interesting mechanisms are in place to promote job creation and

environmental investment. One such programme is the '*chèque-formation*' mechanism in Wallonia which is described below.

The 'chèque formation' project in Belgian Wallonia

SMEs or larger companies planning to hire an unemployed person to work on environmental projects within the company such as renewable energy investments, resource management, compliance with legislation, training, or the setting-up of an EMS are entitled to receive a three-year-long reduction (discount) in non-wage labour cost.

Occupational safety and health

As in the environmental field, the use of EIs for OHS reasons is still in its early stages, although some countries, including France, have used them for some time in this way. In some Member States health and safety costs are perhaps seen as being mainly the problem of the employer although they also fall on society in general through demands made on health and social services. As with environment, those responsible for poor health and safety should be made to pay, for example through higher national insurance premiums.

In France there is a mandatory occupational sickness insurance system whereby premiums can be discounted by up to 25% for employers who take special measures to protect the health and safety of employees and who employ less than 200 staff. Premiums are based on occupational risk rather than sector. However, the differences in the premium are regarded as too small to create an incentive to change behaviour. Special loan and assistance schemes are also in place for employers keen to reduce the risk of accidents at work. Italy has a similar approach as described in the box below.

EIs in Italian health and safety policy

While Italian OHS policy is dominated by command and control measures, EIs are also used. Insurance for occupational accidents and illness is mandatory for employers and managed by the public institute INAIL. Premiums are based on complex formulas based on statistical records of the prevalence and severity of accidents for over 3,330 classes of employer. Annual premiums can be adjusted by as much as 20% for health and safety reasons. Adjustments of up to a further 15% can be made for the company's record on prevention.

Voluntary agreements

Voluntary agreements (VAs) cover a range of non-statutory undertakings by firms to implement improvements to practices, report performance, etc. Generally they are negotiated with industry under the threat of a statutory tax or regulation that will be brought in if solid progress is not made. Such agreements have been used widely in the EU and in particular in the Netherlands and Germany although there have not been any EU-wide voluntary agreements.

According to KPMG (1997) and others (EEA, 1997), VAs offer a number of advantages over other forms of policy instrument:

- they can be quick to develop;
- they involve economic actors (e.g. sector associations) in an active and motivated role;
- they provide flexibility in terms of the approaches taken;
- they are generally less bureaucratic and hence cheaper to implement.

On the negative side they can:

- allow 'free-riders' to take advantage of the voluntary approach to improvement;
- fail to produce the required improvements, resulting in the need for other forms of instrument (e.g. formal regulation) and hence causing delay and extra cost.

In terms of 'free-riding' it is worth noting that in the Netherlands this problem is dealt with via the local authority permitting system. Local authorities take a company's 'declaration of intent' into account when issuing a permit and apply supplementary conditions which come into effect if the company fails to meet its obligations. In terms of examples of failure, it was recently reported (ENDS Report, 2000) that the Dutch VA within the printing sector failed to achieve target VOC reductions.

Voluntary agreements have, however, been used very successfully in various EU Member States. Examples include agreements between the Dutch Government and the photographic sector and in Portugal between the government and the pulp and paper industry. In the latter case the agreement apparently resulted in a reported 60% reduction in pollution from the sector. In the UK a voluntary agreement with the newspaper publishers has increased the average recycled fibre content of newsprint from around 40% in 1998 to the current level of around 55%.

It is important to note that successful VAs are generally negotiated through sector (employer) associations although in some cases also with the involvement of trade unions (employee bodies). The involvement of worker representatives in such agreements is likely to encourage the integration of health and safety aspects and improve their acceptability and hence their effectiveness.

Other types of incentives

Private sector supply chains

Medium and large companies are often in a very influential position when it comes to persuading their suppliers to improve their performance. Many of these companies are now attempting to raise awareness of SD issues, particularly environmental issues, in their SMEs suppliers and to encourage, or even force, the adoption of environmental management systems. The activity is far from uniform, however, with only a small number of companies leading the way. IBM, for example, sent a formal letter to all of its first line suppliers in 1998 encouraging them to implement ISO14001. In part driven by the bad publicity surrounding Brent Spar and their Nigerian operations, Shell Expro has now developed environmental partnerships through its

supply chain and now uses a set of 11 green procurement principles, covering products, services and suppliers, with the aim of improving supplier eco-performance and reducing costs.

Other well-known examples in the EU include Volvo, BMW, Rover and Jaguar in the automotive sector, Nortel and Nokia in the telecoms sector, and IKEA, B&Q (a UK home improvement retailer), and J. Sainsbury (one of four large UK food retailers) in the retail sector. B&Q, for example, will not now purchase paint from suppliers without an EMS, an important driver given that it controls 50% of the UK domestic retail paint market. Eco-labels and eco-declarations also play an important part, allowing companies to more easily assess and compare products.

Volvo and supply chain pressure

Volvo has recently introduced the Volvo Environmental Management System (VEMS, which meets the EMAS and ISO14001 standards) into all of its own operating units. As part of its holistic approach, VEMS complements Volvo's health and safety and quality systems and covers the complete life cycle of the company's products, from design through to use. Suppliers are now being required to develop internal working procedures that cover:

- data on environmental effects;
- reporting on compliance and environmental results of measures;
- setting of improvement objectives and action plans;
- compliance with Volvo requirements on use of hazardous substances;
- design for use of recycled materials in products;
- design for recyclability of products;
- choice of packaging to reduce environmental impact.

The major suppliers are required to meet a recognised EMS standard and to adopt a proactive approach to product design by this year. There will clearly be a knock-on effect with smaller and second tier suppliers also having to improve their standards.

Supply chain pressure can also be used to ensure that good occupational health and safety standards are in place throughout the chain, for example through requiring suppliers to have an OHSMS. IKEA is a good example of a company that takes great care to 'control' the activities of its 2,300 suppliers. It does this through a network of 40 purchasing offices throughout the world. One of the first measures taken was to ensure that all suppliers respect national and relevant UN/ILO conventions regarding working conditions. Having adopted an environmental policy in 1991, the company is now encouraging and assisting its suppliers with regard to eco-design, making use of life cycle concepts to do so.

Clearly suppliers can be subject to various 'compliance' regimes from different customers and this can become a significant burden. Many in the automotive sector, for example, work for several vehicle manufacturers at one time. Obviously the greater the degree of standardisation, for example through the use of international and national standards such as ISO14001 and

ISO14031, the better. In terms of the latter, United Utilities in the UK is currently assessing its use as a tool for helping to assess supplier eco-performance, noting that the existence of an accredited EMS does not prove that a company has better environmental performance than another without one. Many companies merely use a self-assessment questionnaire approach which suppliers often find time consuming and of little benefit to themselves. While ISO14031 may be more time consuming, at least initially, it does allow companies to benefit from reassessing the way they do things and the opportunities for eco-efficiency cost savings. As noted earlier, monitoring and measurement are the key to understanding threats and opportunities.

Contractual arrangements can also provide strong motivations to improve performance. Leasing of equipment, from vehicles to photocopiers, for example, gives the manufacturer/supplier a direct incentive to make the item more durable and more readily refurbishable or recyclable after take back. An interesting development in the area of chemicals supply is that of 'shared savings' schemes as outlined in the box below. These are common in the US automotive industry where the partnership approach to chemicals supply and use has brought large environmental and cost savings at Ford, GM and Chrysler.

Shared savings schemes

The basic idea is that the suppliers of chemicals and other such materials are paid a fixed but relatively low fee for every item that the customer manufactures. The materials supplier then makes its profit by using its expertise to help the company to make savings, for example through rationalisation of purchases, use of more cost-effective chemicals, reduced consumption, reuse and recycling, etc. In some cases the supplier also takes over the process where the chemical is used, for example in car body degreasing prior to spraying. Since the customer shares the savings with the supplier there is a clear financial incentive for both parties.

Private financing and insurance

It is also worth noting that banks and insurance companies are taking an increasing interest in the environmental and ethical performance of organisations to whom they lend money and insure. This is driven mainly by an increasing awareness of liability issues, for example in relation to the contamination of land or personal injury. Banks now often conduct risk assessments before lending money on projects with significant effects while insurers take historical data and risk control measures into account when calculating premiums. The Association of British Insurers recently produced 'Recommendations for the Underwriting of Pollution Risks' with the help of the Environment Agency.

The rise of 'ethical' investment funds and banks is also helping to increase pressure on companies by requiring them to adopt policies and submit statements and reports. Banks such as the specialist Triodos bank in the Netherlands and 'regular' banks such as the Co-operative Bank in the UK have taken a lead in this regard, investing only in organisations that meet their particular assessment criteria.

Public sector funding and purchasing

Public sector organisations such as regional governments, local authorities, development agencies, etc. can also have a considerable impact through making lending and grant allocation conditional on environmental and social performance. This can be a particularly powerful lever with 'new start' companies who may be in a better position to integrate sustainable development ideas into their whole business ethic.

Green public procurement can also be a powerful mechanism, the public sector being a large purchaser of goods and services. The Spanish Government, for example, adopted a law in 1997 whereby an environmental evaluation is a basic requirement for obtaining any public contract with the Ministry for the Environment. The UK National Health Service, which controls over £3.5 billion of public spending each year, has recently begun introducing environmental criteria when considering products and suppliers. A number of local authorities in the EU also have green procurement policies. Sutton (a London Borough), which spends around £120 million each year on procuring goods and services, has been pressing its main suppliers to adopt an EMS and has adopted a corporate purchasing policy, with each department targeting their top ten items for 'greening'.

Public and consumer pressure

Public pressure, applied directly and through NGOs and lobbying groups such as Friends of the Earth, can make a difference and can certainly raise awareness of issues. Action taken by Greenpeace, for example, led recently to Shell abandoning its plans to sink the Brent Spar oil-rig in the North Sea. It is the public as the consumer, however, that wields the most power as the recent opposition to GM crops has clearly shown, many manufacturers and retailers (such as Marks and Spencer) backing rapidly away from their use.

That said, consumer power is limited by a number of factors. To begin with consumers are often not clear about the issues, which can after all be quite complex (is a plastic milk container 'better' than a cardboard milk carton?), and can be faced with making choices based on misleading or incomplete (often no) information. This is partly an educational problem and partly an information supply problem. Eco-labels and declarations are one way of addressing this problem from an environmental perspective although they currently apply to only a small proportion of products.

There is also sometimes a perception issue to overcome. Goods made from recycled materials, for example, have historically been perceived as being of inferior quality. Better control of material supply and product manufacture has largely made this a misconception, with perfectly adequate low and high specification goods now being made with recycled content, often without the consumer's knowledge (e.g. most paper tissues, glass containers). Furthermore, the average consumer does not expect to pay more for products and services that are 'greener' or produced and traded more ethically. Unfortunately the fact that environmental and social costs are generally not internalised, combined with low production volumes, means that more 'sustainable' items often cost more, deterring all but the affluent.

Chapter 5 Education, training and other support

In most Member States, HSE education, training and assistance (the term ‘support’ is used to cover all three here) has been provided to business for many years and there is no shortage of vocational courses and support initiatives. As one would expect, the nature of this activity has tended to track the policy debate and the developments occurring amongst the ‘early mover’ companies. It has therefore progressed through the four stages that have already been defined earlier as the sustainable production hierarchy, i.e. eco-efficiency, eco-design, integrated approaches (e.g. addressing health, safety, environment and quality) and sustainable production.

While there is a lot going on, there are numerous problems. A number of commentators including ECOTEC (in work for the Foundation and the Welsh Development Agency) and Bichard (2000), have noted that much of the environmental assistance provided is flawed in a number of ways, namely that it is often:

- related to compliance and to dealing with symptoms (e.g. waste, poor workplace air quality) rather than causes (e.g. process inefficiencies and design issues);
- single-topic, dealing with issues in isolation, and involving only certain members of firms (e.g. the environmental manager);
- too general, i.e. cross sectoral and meant for all sizes of company;
- superficial or of poor quality, being delivered by non-experts;
- too passive, mainly offering ‘self-help’ guidance, and one-off or short term support;
- too complex, costly or time consuming for SMEs;
- lacking financial justification in terms of suggested measures.

Support is also often designed, promoted and delivered in an uncoordinated way at the regional level resulting in poor understanding and take-up. As a result, support activity has been relatively unsuccessful when measured, for example, in terms of the number of companies adopting environmental management systems (EMS), reducing their pollution load or making cost savings. This is particularly the case with smaller SMEs which are notoriously difficult to 'reach' from the perspective of the education and support provider. Some of these issues are discussed further below and in more detail in the Foundation's complementary report on *Professional Education and Training for Sustainable Development in SMEs.*

The nature and problems of 'support'

Awareness and perceptions

As already noted SMEs awareness of their needs and the benefits of SD-related work are poor. They also have poor awareness when it comes to education, training and support provisions. With regards to environmental support in the UK, the 1998 Groundwork survey produced some worrying results with 38% of SMEs and 57% of micro SMEs never having contacted a support body or initiative. The two most popular support bodies were Local Authorities and The Environment Agency (see Table 4), although these only accounted for 16% and 12% respectively. Less than 2% mentioned the ETBPP, the UK's flagship eco-efficiency programme aimed largely at SMEs!

Table 4 SME relationships with support bodies in the UK

Organisation	Support body approached/ Considered for assistance	Support body with whom SME had direct contact
Local Authorities	16/15	68
Environment Agency	12/10	<5
DETR	7/9	<5
Health and Safety Executive	6/7	<5
Environmental Consultancies	5	<5
Business Links	<5	43
Chamber of Commerce	<5	52
Trade associations	<5	53
Local university/college	<5	44
Government offices	<5	33
Federation of Small Business	<5	23
Business in the Community	<5	21

Source: Smith, Kemp and Duff (2000).

When prompted as to which support bodies they had direct contact with for general business matters, over 40% had such contact with local authorities, chambers of commerce (and training

enterprise companies), trade associations, business links (the supposed 'one stop shop' for advice) and local universities/colleges. In all but the local authority case, however, less than 5% had or would consider using them to provide environmental advice. The nine Foundation studies on education and training have indicated that a similar situation exists in several Member States.

The implication of all this is that providers are not getting their message through to SMEs and/or that SMEs are confused about who does what. One factor here is the misleading terminology used by support organisations and policy makers. To give an example, the term waste minimisation (preventative and high value) is too easily confused with waste management activity (reactive and low value). In this case the term resource efficiency may get across the objective more effectively. This is more than just a matter of semantics as it can have a major impact on the way support initiatives are received.

A more serious factor is undoubtedly the uncoordinated approach to the design and promotion of courses and initiatives. As noted earlier the sheer number of support initiatives combined with the limited time and resources of SMEs leads to considerable confusion over what organisation does what and what is worth accessing, a combination of information overload and initiative fatigue. Furthermore, there can often be a 'targeting' issue with information being directed at the wrong people within the firm. This essentially reflects a lack of information on the part of the support provider resulting from lack of local knowledge and contacts.

Perhaps most important of all, however, is the credibility of the provider. Companies have to know that they will get the right service at the right price, delivering really practical and cost-effective results.

Topic coverage and integration

The Foundation report on *SME Support Systems for Sustainable Development* (EFILWC, 2000) found the vast majority of 'support' initiatives (programmes and projects) in the EU are in the eco-efficiency area, all Member States have initiatives dealing with waste minimisation, clean technology, energy efficiency and particularly EMS (e.g. ISO14001). In terms of vocational education and training courses, the nine national Foundation studies on *Education and Training for Sustainable Development* have found numerous examples dealing with environmental management in business. There are few examples of integrated courses and support initiatives, although some countries such as Denmark and Portugal do have initiatives in place that deal with health, safety and environment in an integrated fashion.

Far fewer vocational courses and support initiatives deal with eco-design and more fundamental approaches to 'sustainable production', the latter in particular being still largely in the R&D sphere. The leading countries here seem to be the Netherlands, Sweden, Germany and the UK, although a number of Member States are at least running eco-design courses and providing support (e.g. Belgium and Ireland). Where Member States have introduced programmes relating to eco-design and sustainable manufacturing, these are almost always complementary to, or part of, programmes covering eco-efficiency and occupational health and safety.

This is quite proper given that companies need competencies covering the whole SD spectrum and that relatively few companies, and in particular SMEs, have actually made any sort of serious progress in these less-advanced areas. While it is clearly important to progress and disseminate eco-design and sustainable production ideas, it is imperative that eco-efficiency concepts are still pursued with vigour, particularly amongst SMEs[10]. The degree to which such concepts should be presented to SMEs as an integrated package is debatable however. SMEs have very limited resources and cannot generally deal with a multitude of ideas and approaches at one time. This issue is discussed further below.

Quality and appropriateness

Various means are used to deliver training and other forms of support. The 'passive' mechanisms are most common (partly because they are relatively cheap) and include paper guides, electronic databases, CD-ROMs, telephone helplines, seminars, etc. More and more data is, of course, also available through the Internet and web sites. According to UK surveys (Groundwork, 1998, Arena Network, 1997) SMEs most favour printed information, telephone helplines, local consultancy advice and local seminars/workshops. In the Groundwork survey only 44% were interested in information over the Internet although this is probably changing fast as companies improve their IT equipment and Internet access. Not surprisingly, national conferences were the least favoured due to the time and cost involved.

While passive information can certainly help, small and micro SMEs generally need more 'active' (hands on) and long-term help. This is now quite widely accepted although the cost can be prohibitive. Where they exist, more 'active' approaches generally involve the limited use of subsidised consultancy work, for example in terms of providing one-off eco-efficiency reviews, telephone counselling, etc. rather than ongoing interactive help over a period of years.

Where training and assistance is too general and/or too superficial this often disappoints and turns companies off, particularly SMEs. On the other hand where tools, guides, etc. are too complex, SMEs often do not have the time and/or knowledge to use them. A balance has to be reached whereby the information that is provided is very practical, concise and specific. Another important factor is financial justification. It is no use suggesting improvement measures without showing that they can be cost-effective.

Encouragingly, the Foundation's report on *SME Support Systems* found that while scarce in the past, there now appear to be a quite significant number of support initiatives, particularly on the eco-efficiency side, aimed specifically at SMEs, including small and micro firms. In a number of cases SME-specific initiatives have developed as part of more general 'all industry' initiatives. The report notes that while many of the eco-efficiency initiatives are aimed at SMEs, most of the eco-design and sustainable production initiatives do not specifically target SMEs. This is perhaps

[10] It is worth noting that, in any case, waste minimisation or clean technology activity can be very important in sustainable manufacturing terms, for example involving a better workplace environment, zero-discharge manufacturing, waste-exchange between companies (e.g. UK ceramics sector), etc.

to be expected given that smaller companies tend to be some way behind larger companies in terms of adopting new ideas, despite the fact that they can often be well placed to innovate.

Towards better support

Making support initiatives successful is not easy, particularly with regard to SMEs. There are however a number of approaches and factors, both strategic and operational, that can be effective. These are discussed below.

Long-term strategic planning

As noted earlier, it is important that leading companies take a long-term strategic view, establishing where they want to be in ten or twenty years and then 'backcasting' to establish what they need to do today. The same applies to policy makers developing support initiatives aimed at providing more fundamental step changes in approach. In terms of supporting sustainable technology development, Weaver et al (2000) note that public programmes should play a facilitating role, supporting the innovation process rather than trying to pick and back prospective technological winners. To this end they suggest a range of pointers for support programmes as set out in the box below.

Lessons from the Dutch STD Programme (Weaver et al, 2000)

- Take a wide view (multi-sector, multi-resource, multi-need) that allows all possible synergies to be considered;
- take a long-term perspective (50 years) to allow radical breakthroughs to be investigated;
- set ambitious targets as 'working hypotheses';
- focus on key problem areas such as energy and materials;
- ignore existing solutions, starting only with the basic need or task;
- emphasise diversity in exploring solutions;
- emphasise 'learning by doing' rather than theorising;
- use examples from the natural world as a source of inspiration;
- help to build new networks, bringing research institutes, public bodies and technology users together;
- help network members to reach common problem definitions, shared visions, etc.
- provide information and tools that will allow long-term visions to be translated into short- term actions steps;
- encourage the integration of technological, cultural and structural developments so that they are mutually supportive;
- disseminate activities and findings widely.

It is encouraging to see programmes such as the Economy, Ecology and Technology (EET) Programme in the Netherlands and others such as the DBU Funding Programme in Germany, the

Ecological Sustainability Project in Sweden, and the Sustainable Technology Initiative in the UK taking this longer term view on sustainable production (see box below and the Foundation's recent report on *SME Support Systems for Sustainable Development)*.

Economy, Ecology and Technology (EET) Programme (Netherlands)

The EET Programme has been operating since 1996 with the aim of enabling consortia (scientific institutions and companies) to develop fundamentally new technological solutions. The programme themes cover process water, industrial waste, eco-design, traffic and transport, renewable raw materials and renewable energy. Some 12 consortia received a subsidy in 1996 and a further 14 in 1997 (90 million guilders total). Interesting projects to date have included:

- preparation of biodegradable latex and rubber from renewable raw materials;
- zero-discharge fermentation of bakers yeast;
- vegetable resin as a binder in paint;
- inulin (from chicory root) to replace petrochemical derivatives;
- oil from biomass at a competitive price.

It is also worth noting the 'top-down' Dutch approach to environmental planning and support, the key to this being the National Environmental Policy Plan (NEPP). This is revised every four years and in its current incarnation sets demanding thematic targets in various areas such as climate change, acidification, waste, nuisance, etc., covering the next 25 years. Target groups, such as industry sectors, agriculture, transport and consumers, are then given responsibility for meeting the targets. As noted earlier, voluntary agreements, backed by direct regulation, play a key role. Networks are then used to stimulate action as discussed further below.

The JRC report on Eco-Design (JRC, 2000) notes that best practice in the product design area should involve:

- clear planning and coordination in method development;
- method development and testing involving organisations with good experience in terms of industry design issues;

It is also important to note that a strategic decision should be made about the type of company to be supported. Rather than taking a blanket approach, for example aimed at all industrial SMEs, there is a strong argument for supporting only certain key sectors. One has also to think carefully about the size of company that should be supported. Micro-SMEs cannot be ignored as they represent such a huge proportion of companies, although there is perhaps a case for giving sole-traders a lower priority. While programmes have to support established companies it is important to note, however, that new or start-up enterprises are an extremely important group as they have yet to become set in the way they do things or to form rigid ideas. While some will fail to develop, many will become the future basis of the EU economy.

Operational support issues

Recent work by the Foundation (*SME Support Systems for Sustainable Development*) and others (De Bruijn et al, Tunnessen, Pedersen, etc.) suggests that there is a range of approaches and particular factors that make for more successful support, particularly in relation to SMEs. These processes and success factors are noted in the box below and discussed further in the following sections.

Key success factors in SME support for sustainable development

- careful planning based on a genuine understanding of SME needs;
- careful coordination on a regional or sub-regional basis;
- coordinated delivery through local/regional networks/partnerships and 'conduits';
- delivery involving supply chains where possible;
- careful targeting – key company managers and other 'gatekeepers';
- use of genuine sector/subject experts;
- use of sector specific material and tools where possible/appropriate;
- use of SME-specific material and tools – concise, simple, quick and cheap;
- use of 'active' support, which 'interacts' with companies through the improvement process;
- provision of longer-term support to allow the transition to be completed;
- topic integration, e.g. combining health, safety, environment, quality;.
- involving an integrated company team lead by a 'champion'.

Mentoring

SMEs in particular respond well to active support, that is support which is more 'hands-on' and interactive, helping a company to improve through examination of specific company issues over an extended period of time. It is important to note that the aim should be to transfer competencies to the companies being supported rather than just go in and solve specific problems. Similarly, where tools are provided they should be appropriate to the needs of the company and staff should be trained to use them.

This approach to support can be termed mentoring rather than consultancy, although it can of course involve the subsidised use of consultants for example. According to Kaye and Jacobson (1996), the role of the mentor is to facilitate intentional learning that enables the development of the mentee's skills through instructing, coaching, modelling and advising. According to Tunnessen (2000), a successful mentoring programme should also facilitate a positive change in attitude towards environmental management and its relationship to economic efficiency.

It is acknowledged by most commentators that one-to-one mentoring is the most effective as it directly addresses the specific needs of the company mentee. It is, however, time consuming and expensive. 'Cluster' (one-to-several) mentoring (e.g. through a waste minimisation club)

provides valuable information and training to a wide number of companies, for example in the same sector or supply-chain, in a cost-effective manner. The downside is that it is difficult to address issues related to individual companies.

As noted earlier, specific and high quality advice is essential if companies are to continue to heed that advice. So as to ensure high standards of support and training, and to give confidence to SMEs selecting services, accreditation of individuals and courses is useful. In the UK, for example, the Environmental Auditors Registration Association (EARA) and the Chartered Institute for Water and Environmental Management (CIWEM) provide such accreditation where strict standards are met. There may even be merit in having national registers of accredited advisors, although the criteria used would have to be carefully determined. Ideally, mentors/advisors or indeed any support provider should have strong practical experience, particularly in the relevant sectors, and good communication skills as well as competencies in the subject area. Being able to speak the 'business language' should be a pre-requisite.

Tunnessen (2000) notes that government and university-based mentors are sometimes seen by businesses as lacking in commercial/sector experience. According to Tunnessen, business to business and trade association-based mentoring programmes are the most effective with regard to benchmarking and the dissemination of best practice. Consultants can also be very effective, although are generally costly unless subsidised. Two interesting approaches can, however, be taken to keeping down costs. Firstly retired or semi-retired people, e.g. from industry or consultancy, can be used. In the USA, for example, the Service Corps of Retired Executives (SCORE) has over 12,000 volunteer mentors on its books in 389 regions, bringing a lifetimes experience to small companies. Secondly, and at the other end of the scale, a particularly cost-effective means of providing extended support involves the use of graduate placement, i.e. the subsidised placement of environmental or health and safety graduates with a company. A number of such schemes exist in the UK, one of the better-known ones being the Student Force for Sustainability.

While such young people rarely have much business or sectoral experience, they should (if chosen carefully) have good subject knowledge, for example in relation to EMS or waste minimisation. As such they can offer an extra 'pair of hands' to gather and analyse data, explore costs and benefits of improvement options, etc. In this way the company gets a low-cost resource that complements the firm's knowledge of its own business and processes. Often this leads to companies making significant improvements whilst saving enough money to give the graduate a full time job. It should be emphasised that such graduate placement schemes are best used to supplement, rather than replace, 'expert' mentoring.

Tunnessen (2000) notes some key practical issues with regard to successful mentoring. Before any mentoring takes place, it is important that the mentors and mentees define and understand exactly what they expect from each other. If mentoring is to be conducted on a formal basis, a letter of commitment should be drafted. This outlines the roles of both parties, set specific objectives e.g. time frame, and if necessary provides a confidentiality agreement and addresses

any security, legal and liability issues. Tunnessen stresses that baseline knowledge of the mentee should also be evaluated before work commences. The box below lists these and other elements that are important for establishing a successful mentoring relationship.

Elements for successful mentoring (Tunnessen*)*

- Commitment. Both organisations must have a strong commitment to seeing the process through. Uncertainty on the part of either party may yield disappointing results for one or both participants.
- Goals. Clear, realistic, goals that include time-lines for meeting established benchmarks should be set.
- Criteria. Appropriate goal setting is dependent on the criteria that both the mentor and mentee have established for themselves and their partners.
- Obstacle identification. Identify in advance any obstacles that would prevent the implementation of any proposed recommendation.
- Needs assessment. Mentees, with help from the mentor, should complete a needs assessment survey to determine their interests, capabilities and resources.
- Similar business interests. Businesses that are either in the same industry sector or use similar processes are more likely to form successful mentoring relationships. Also, it is important to match 'skill sets' between individuals from the mentor company to those in the mentee's staff.
- Plan a 'self-directed' project. Look for opportunities for the mentee to put what it has learned into place.
- Flexibility. Mentors should be flexible in their approach and adjust to the needs of the mentee.

In addition, mentors should remember the following:

- Keep it simple. Mentors cannot assume that the mentee has the same level of experience, education and understanding of issues as they do. Therefore, mentors should be able to translate complex concepts into plain language and avoid using technical jargon.
- Focus on the practical. Mentees from small business respond best to 'how to' information they can put to work right away.
- Understand time constraints. Most small businesses are spread thin. Time is money so, consequently, SMEs operate under tight time constraints.
- Eliminate preconceived notions of what the SME needs. Mentors will be more successful if they listen to the needs of the mentor as opposed to telling them what they need.
- Use business language. Frame advantages in terms of costs savings, efficiency and profits.
- Seek industry affirmation. If possible, check with contacts in industries similar to the mentee's to identify benchmarks and general suggestions to make sure you are going in the right direction.

Other features of successful support

Integration

In terms of the range of topics that should be covered, it is clearly important from a sustainable development perspective to deal with the entire spectrum of topics, but with a different emphasis to suit the circumstances in particular regions, particular sectors and even particular SMEs. In terms of mainstream industrial and commercial SMEs, it probably makes sense to focus on getting across eco-efficiency ideas before introducing the more difficult messages of eco-design and 'sustainable production'. As Tunnessen notes, 'abstract discussions about materials flows and industrial ecology are not particularly helpful to the small business person who is just learning the basics of environmental management'.

It is clear, however, that small SMEs do not want to be burdened with too many systems and tools covering a wide range of topics and approaches. As noted earlier, there is certainly a case for greater integration so long as the resulting systems are not themselves too complex to use and understand.

Planning, coordination and networks

As noted already, some initiatives suffer from the fact that they compete with overlapping initiatives within the region, each operating with its own source of funding (often under ESF or ERDF), its own objectives and methods. Good practice should involve regional coordination in terms of the design of the initiatives and their promotion and delivery, all based on proven 'best practice' methods. This implies the need for strategic fora and preferably partnerships involving, for example:

- regional development agencies;
- regional/local government;
- regulatory bodies;
- sector organisations;
- not-for-profit groups;
- higher education institutes;
- large/influential local companies;
- local consultants and experts.

In order for a partnership to work, each player needs to define their level of competence, and hence their potential in terms of their roles and responsibilities regarding topic coverage and the nature of support provided. It is also important to identify the potential for geographical and sectoral coverage. Overall this process should allow any gaps to be identified and delivery to be effectively and efficiently organised. Besides providing relevant expertise, partners can also provide resources in the form of time and funding.

In the Dutch model of environmental support much emphasis is placed on the use of regional intermediaries in the form particularly of the Industrial Environmental Agencies (BMD) and the innovation centres (Syntens). In addition the social partners, through trade (employer) associations and trade unions, are expected to play a major part, the former through providing guidance (e.g. handbooks, workshops, etc.) and the latter through informing shopfloor staff of their role. Local authorities are expected to support activities within their area while consultants and others (e.g. universities) provide additional assistance to companies. Central government provides motivation and funding. The roles of these organisations, according to De Brijn et al, is summarised below in Table 5.

Table 5 Role of Dutch network oganisations as support models

	Motivating	**Supporting**	**Pressurising**
Trade association	X	X	X
Local authority	X	X	X
Regional agency BMD	X	X	
Trade unions	X		
Consultants, etc.		X	
Central government	X	X (financial)	

This network approach appears to be very successful. De Brijn et al note that 92% of companies questioned were familiar with the terminology, 62% were in possession of the guidance material, 54% had attended support meetings/workshops and 43% had implemented some action with the support of the network. The researchers note that 55% of companies overall had initiated some action. In Italy, support is in many cases organised through local clubs relating to industrial 'clusters', the firms in the relevant districts helping to support each other. The concept is described in the box below.

The Italian industrial districts and the *Club dei Distretti*

An Industrial District is a spatially concentrated group of firms (many of whom are SMEs) which are often engaged in single or interrelated industries. There is a high level of interaction between firms but this interaction is not governed solely by standard forms of agreement such as legal contracts because there is also a significant element of trust between actors. The Industrial District concept emerged from Italy where such complex interrelationships exist between firms (and also other local actors) in a number of different areas (with the most high-profile probably being those in Emilia Romagna). Examples of clusters within Italian Industrial Districts are Biella and Prato (textiles) and Busto Arsizio (machine tools).

The *Club dei Distretti* is an association of various bodies (trade associations, chambers of commerce, trade unions, service centres, etc.) operating in Italian industrial districts. The main aims of *Club dei Distretti* include:

- promoting exchanges of information among various production systems;
- promoting initiatives aimed at supporting the development of local productive systems; and
- promoting relationships between industrial districts and institutional bodies.

The *Club dei Distretti* model as a way of supporting SMEs potentially has significant relevance from a policy perspective because the success of Italian industrial districts has prompted other regions across Europe to attempt to create them through policy measures.

Other support models are also trying to make greater use of regional coordination and local delivery. In Wales, the Welsh Development Agency is supporting the establishment of a network of business and environment co-ordinators (BECs). The BEC will act as a conduit between local businesses/landowners and the providers of environmental support and information, through relevant centres, fora and committees (Figure 12). The BEC will also act to co-ordinate and facilitate local networks, clubs and working groups. The BEC should act as a catalyst for change, encouraging environmental improvement (in terms of the physical environment of the area and the minimisation of pollution and wastage) as part of a move towards sustainable development. The intention is that the BEC becomes a well-known 'friendly face', someone that companies can trust and rely on to actively assist them in accessing appropriate and cost-effective support and getting their concerns and needs across to those in a position to support them (funders and practitioners).

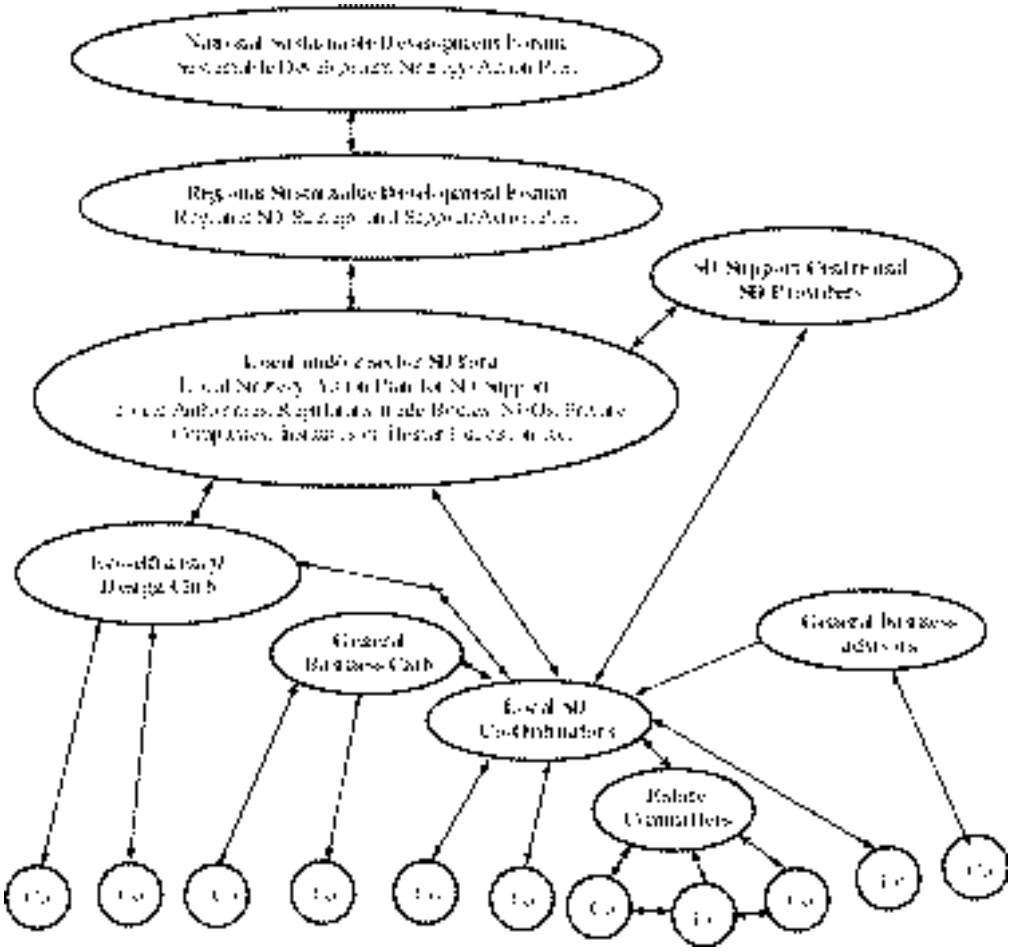
Such a model takes the Dutch model to a more local level by providing the more intimate links to the companies themselves. The development of trusting and quite long-term relationships does in fact seem very important, certainly in the UK. It is far better to co-ordinate and use existing networks, so long as they involve good relationships, rather than trying to start afresh. It is encouraging to note that the Foundation's study on SME support systems notes the existence of a significant number of 'centres' which provide a long-term resource for companies to use at the local or regional level. Local/regional environment business clubs and networks are also common in many parts of the EU, providing useful and low cost general support.

Marketing and targeting

Support initiatives, whether involving local networks or not, need to take care to identify and target the key groups within industry and to market their initiatives in a way that appeals to the mainly economic motives of the firms in question.

In terms of targeting, there is a clear need to reach key decision-makers, in general the senior managers who can provide the necessary commitment and allocate resources. It is then important to help the company find the middle management staff who can actually make it happen and preferably an influential company 'champion' who can motivate from within and lead the improvement team. It is also important, however, to try and reach staff on the shopfloor as these staff can apply pressure upwards (as they have historically with regard to health and safety) and provide useful insights into problems and potential solutions.

Figure 12 Support coordination model



Trade unions can play a particularly important role here, educating workers through works councils for example, emphasising the benefits of an improved internal and external environment to them, their families and their communities. Interestingly, of the five hundred or so works councils in the companies with a pan-European presence, 150 have environmental policy on their agendas (EFILWC, 2000). This means that in these companies regular discussions on environmental matters take place between worker representatives and management.

Human resources staff can also help to educate and motivate through the staff development process, making SD awareness a training goal and a criterion for progress. In the UK, for example, the Investors In People Standard, which is awarded to companies which apply a systematic approach to staff training and development, could be used in this way in the future. Another approach is to encourage children to educate their parents. Most children now get some form of environmental education at school, from their teachers and through external organisations, and this can be used to get across messages relating to the role their parents can play in their place of work.

As an alternative to targeting company staff directly, providers can target so-called ‘gatekeepers’ in the business community, particularly influential people in large firms, local authorities,

funding agencies, etc. Going in through supply chains (private or public) and funders can offer a very valuable multiplier effect, making initiatives more cost-effective. This is effectively supporting the supporters, and something that would need to be carefully controlled to ensure, for example, that money is spent in an appropriate and accountable way. More is said about supply chains and mentoring below.

The role of local authorities and regulators

While local authorities are well placed to take part in support networks, having local knowledge and appropriate contacts, there is a fundamental problem in that they generally also take on a regulatory role. Can they be the gamekeeper whilst helping the poachers? The same applies to Environmental Protection Agencies. If such bodies are to provide environmental support, they clearly need to earn the SMEs trust by convincing them that when they provide advice, that is all they are looking to achieve. In other words they will not abuse their situation by searching for opportunities to prosecute. The 'fear of reprisal' has to be removed.

Pedersen (2000) argues that in Denmark the local authorities have been successful in taking on a more advisory role, expanding their traditional inspection role and establishing closer ties with companies. According to Pedersen there are a number of advantages to using local authorities in SME environmental support schemes, these being discussed in the box below. Given their existing roles, it could be argued that the local authority should be the 'hub' of the network. Pedersen notes that the authorities in Denmark often initiate networks, host the secretariat, plan and co-ordinate and sometimes co-finance.

Local authorities as the initiator and catalyst for environmental improvements

- The local authority knows the local business community.
- The permitting department of the local authority is responsible for the local environmental policy and the issuing of permits to the companies.
- The permitting department of the local authority has knowledge of environmental legislation, cleaner production alternatives, experience from other companies, etc. that should be disseminated to SMEs.
- The department of economic affairs has an important role in promoting a healthy local economic climate in which the companies can flourish. In addition, this department is responsible for attracting new companies to its city.
- The local authority will have to agree with the reconstruction and building activities of companies and is, therefore, in many ways the logical partner of the local business community.
- The local authority is not only familiar with the local business community, but also with other local intermediaries that could help promote the proposed environmental activities, such as banks, insurance companies, chambers of commerce, etc.

Source: Pedersen, from BECO and Deloitte Touche, 1998.

This is very different from the UK and Spain where the local authorities tend not to have a particularly good relationship with local business and hence tend to operate more at 'arms length', within local partnerships but not often actively delivering support. This is less true of the Environment Agency in the UK which has taken on a more advisory role in the last three years or so, particularly in relation to eco-efficiency and pollution prevention, often being part of waste minimisation schemes and the like.

Sectoral and supply chain approaches

Sectoral approaches, driven by trade (employer) organisations, provide the type of sector-specific approach that SMEs want to see. Sector-based approaches, for example to introduce sector-specific EMS or to meet the requirements of voluntary agreements, have been particularly successful in the Netherlands, and are even pursued in very small and micro SMEs[11]. Sectoral approaches can also mesh with regional and local initiatives, providing specific training and tools for key sectors in that region which can be used by local providers.

Supply chain initiatives can also be a very effective approach, particularly where large companies provide support rather than just applying pressure. Supply chain support concepts and initiatives are becoming increasingly common, as noted in the Foundation's report on SME Support Systems. As noted already, SMEs want their advice to be practical and business oriented. Business to business support (mentoring – see below) can offer this sort of credibility. Generally businesses that are in the same industry sector or use a similar production process form the most successful mentoring relationships. SMEs are more likely to be persuaded about the value and importance of having a good environmental management programme by their peers than they are by an 'outsider'. Customer companies (and supplier companies where they are important enough, e.g. in a monopoly situation) also have the advantage of being able to apply pressure, either directly or more subtly.

Supply chain mentors need to have sustainable development competencies as well as knowledge of the sector and its products and processes. Ideally they will have been through a training process themselves and applied what they have learnt in practice to bring about real improvements. Mentors must obviously be willing to share that knowledge and have the personality and communication skills to do that effectively. But why should companies support other companies? Tunnessen again makes some useful observations, noting that mentoring produces benefits to both the mentor and the mentee, some of which are set out in the box below.

The benefits of mentoring

Benefits to the SME mentee:

- gain free/cheap expertise;
- access practical and specific advice and suggestions;

[11] The Dutch 'branch code path' to EMS and Total Quality Management (which covers quality, environment and health and safety).

- catalyse improvements which save money;
- demystify technical issues;
- develop better and more durable relations based on trust.

Benefits to the mentor (mentoring outside the supply chain):

- recognition as an environmental leader by the public and regulators;
- improved community trust;
- improved employee satisfaction;
- increased knowledge about environmental management systems;

Benefits to the mentor (mentoring inside the supply chain):

- ensure that suppliers/customers meet corporate policy/standards;
- improve supplier quality and reliability;
- identify 'best' suppliers to allow future selection/de-selection;
- develop better and more durable relations based on trust.

Source: Tunnessen, adapted by ECOTEC.

In the USA the EPA's Environmental Leadership Programme (federal government) provides environmental management assistance, on a one-to-several basis, using large companies within the same industry sector. Using such 'gatekeepers' potentially provides a multiplier-effect making support provisions more cost-effective. The research for this report has not found any such national supply chain mentoring programmes, although there are a few examples of publicly supported schemes such as the one mentioned in the box below.

In addition there are quite a large number of private sector schemes run by large national and multinational companies, particularly involving the automotive, electronics/telecoms and retail sectors as noted earlier (companies such as Ford, Procter and Gamble, IKEA, etc.) It is worth noting that it is not always the customer that provides the support. Large manufacturers of such products as speciality chemicals (e.g. inks), may in fact give advice to small customers (e.g. printers). This is quite common in the EU and in the USA, shared savings approaches being taken in some cases.

Eco-design and Training for Manufacture, Use and 'End of Life' – ETMUEL (UK)

ETMUEL is a training programme, run by the Centre for Sustainable Design (CFSD), focusing on the implementation of environmental considerations in product development and design in electronics sector SMEs. The initiative will run for two years from 1999 to 2001 and the target audience is SME electronics manufacturers, component suppliers, designers and recyclers. Through this project CFSD is developing eco-design tools that can be

implemented both directly with SMEs (manufacturers, recyclers and design consultancies) and indirectly through the supply chains of large companies (Supply Chain Partnerships (SCPs)). With regard to SCPs, CFSD will work with manufacturers and systems integrators to communicate and implement eco-design issues throughout the supply chain. For both groups, activities will be supported by a series of workshops aiming to explore problems and opportunities involved with the implementation of eco-design. Existing eco-design checklists covering management and technical aspects will be made available to participants and new eco-design tools will also be developed. A follow-on eco-design training programme will be developed for a limited number of individual companies.

While supply chain initiatives are undoubtedly a useful approach to the SME support problem, one has to note that they are not a panacea. SCIs definitely work better where the supply chain is geographically contained, ideally at the local or regional level. Clearly it is easier to work with suppliers and customers that are not too far away. Economic clusters, for example as found in Italy (e.g. the Industrial Districts) and the UK (e.g. the ceramics industry in Staffordshire), allow close co-operation.

Some sectors, however, are not necessarily well suited to supply chain approaches. In the electronics sector, for example, the first tier suppliers are often themselves multinational companies (for example chip manufacturers such as Intel) while second and third tier supplier companies may well be located in the USA or Asia. While this can make mentoring difficult, it need not stop companies from providing more passive support and guidance or applying pressure, for example with regard to EMS or health and safety. Companies such as IBM and Ford tend to apply the same conditions to their suppliers irrespective of their location.

Chapter 6

Towards better management systems and tools

Management systems

Environmental management

Perhaps the most important form of voluntary instrument is the formal management system. Chapter 1 has already discussed the uptake of environmental management systems in the EU and attitudes to them, particularly amongst SMEs. Systems such as EMAS and ISO14001 certainly have an important part to play, bringing a systematic approach to environmental improvement that requires companies to think carefully about their practices and to put in place appropriate procedures. Importantly, EMAS also requires public reporting of performance.

While these systems are very useful, it is argued that their complexity deters the vast majority of SMEs from implementing them, even though there is specific guidance for SMEs through ISO 14002. This has led to a range of simplified systems such as ISO14001-light in Sweden and the Enviromark and Project Acorn systems in the UK and Ireland (see box below). SMEs are not a homogenous group of course and hence what may suit medium-sized companies in one sector may or may not suit a small or micro SME in another. The Dutch Branch Code Path (BCP) recognises this and provides sector-specific EMS and TQM for the smallest of firms. The approach is based on a Deming improvement cycle making use of best practice guidelines and procedures, simple risk analysis and evaluation and the making and implementation of a prioritised list of actions.

The Acorn Project: An incremental approach to ISO 14001 for SMEs

The British Standards Institution (BSI) and the Irish Productivity Centre, Dublin, have developed an incremental implementation model of ISO 14001 for small businesses. The model is being developed with the support of the UK DTI. The basic aim is to allow SMEs to undertake staged ISO 14001 implementation in a way that does not burden them yet provides an opportunity to demonstrate progress. BSI is piloting the approach in the UK under a two-year programme, working with 20 large companies and 250 small suppliers. A central feature of the programme is that supply chain co-operation is facilitated to allow shared environmental and organisational goals to be met. The model breaks down the ISO 14001 implementation process into five levels:

Level 1 : Management commitment, initial review, awareness raising/training

Level 2 : Environmental policy, register of legal and other requirements.

Level 3 : Identification of significant environmental aspects and impacts.

Level 4 : Management of significant environmental aspects. monitoring, audits, corrective action, procedure development, documentation, etc.

Level 5 : Systems integration and certification. centralised manual and certification audit.

At each level, the SMEs is audited (under a process accredited by the UK Accreditation Service) to ensure that they meet the specific audit criteria for the level. Following a successful audit at each level, a certificate is issued to allow the small business to demonstrate to its customers that it is making good progress towards ISO 14001. To support each level, BSI has developed a modular training course that meets the Environmental Auditors Registration Association (EARA) EMS implementation course guidance. This enables them to deliver training to meet the needs of the company prior to each audit taking place, while providing the opportunity for those undertaking the training to obtain a professional qualification. BSI also provide a telephone help-line, and a handbook (with templates, etc.) which has been specifically developed for small to medium sized businesses. A call-off (fixed man-day rate) consultancy facility is also available if required.

It is worth noting also that EMS can stimulate eco-design activity through consideration of life cycle impacts, as the example in the box below from the US construction sector emphasises. This is not necessarily always the case however. As Zwetsloot and Bos (EFILWC, 1998) note, an EMS or HSE system in fact focuses attention solely on control procedures, to minimise damage within the confines of the present processes and products, rather than on improvements, for example through eco-innovation in terms of product design. In fact ISO14001 gives no guarantee of environmental improvement.

Construction design for environment and ISO14001

The Capital Programme Management (CPM) department of New York City Transit Authority recently implemented an ISO14001 system. The aim was to take it from a situation where it dealt with environment in a reactive way, for example dealing with safe asbestos removal and the like, to a proactive position dealing with the life cycle of construction, from planning and pre-design to actual construction. As a project-based service provider rather than a site-based manufacturer, the CPM had to adapt ISO14001 to allow it to properly manage its contractors as well as its own operations that include design. Through the use and development of various handbooks/guidelines and the involvement of environmental specialists at the master plan stage, the organisation has now developed a far more rigorous approach to the inclusion of environmental matters into project design and procurement. The organisation sees the key success factors as:

- having a 'champion' in senior management;
- having a well-defined EMS team with appropriate allies;
- emphasising consistency through existing policies and approaches;
- identifying and developing a pool of relevant internal expertise;
- seeking out and using external information and resources.

Performance systems and benchmarking

The new ISO14031 standard on company environmental performance evaluation (EPE) is interesting in that it focuses purely on properly measured actions and results using appropriate indicators. Lokkegard (2000) notes that the system deals with the environmental aspects of ISO14001 but leaves out the organisational aspects. According to Lokkegard, it is therefore simple to use, requires less staff input (often only one manager) and is of more direct practical value. For these reasons it has been suggested as a possible alternative to, or route to, ISO14001 for smaller companies and as a complement to ISO14001 for larger companies. ISO14031 is being piloted in various parts of the EU at present, one example being engineering giant BAe Systems which intends to use the approach to integrate environment into all aspects of its business as part of its existing ISO14001 system and complementing its OHS and quality systems.

Clearly such performance-based systems require good data and hence careful auditing. In this respect it is worth noting the international auditing guideline, ISO 14010. Careful and consistent performance monitoring clearly also allows 'benchmarking', i.e. comparison with other companies. Benchmarking can be extremely useful although one has to note that sectoral data has to be properly categorised by process and even sub-process, to eliminate 'naturally' occurring variation and that assumptions and qualifications have to be made very clear.

Other systems – compatibility and integration

The relative success of the environmental systems and their 'quality' forerunners, particularly the ISO9000 series, has led to a proliferation of national and international systems, now covering virtually all of the sustainable development considerations:

- the working environment (OHSAS 18001, BS 8800, Swedish Internal Control System);
- safety and accident prevention;
- ethics (e.g. social accountability 8000);
- economics (ISO 10014).

To SMEs in particular, the huge range of systems and related support tools can be bewildering. How compatible are they? Are there overlaps which mean that a system in one area gives benefits in another? Should such systems be integrated? In terms of compatibility, it is worth noting that the revised EMAS regulation will incorporate the ISO14001 standard and that ISO14001 is to be revised to make it more compatible with the ISO9000 series.

In terms of synergies, the Foundation's recent work in this area suggests that the introduction of EMS has often led to the inclusion of safety and health matters in the system or has led to the progress of systematic approaches to safety and health risks and preventive actions. The Foundation's synthesis report on *Economic Instruments for Sustainable Development* notes such indirect benefits through the use of EMAS in the German and Irish dairy, textile and chemicals sectors, for example through better hygiene, noise abatement, improved chemical control and the introduction of less hazardous and odorous materials. Most of the case study companies had also saved money and improved their competitive position as a result.

That is not to say that OSH considerations are always compatible with environmental ones, as noted above. Combining OHS and EM systems, however, allows conflicts to be dealt with in an integrated and more efficient (lower cost) way, rather than as separate issues. There is certainly evidence that SHE management can lead to synergy effects in areas such as the use of chemicals, avoidance of spills, noise-reduction, accident prevention, etc. Zwetsloot and Bos (EFILWC, 1998) note a number of conditions that need to apply if synergies in the two areas are to develop, these being:

- more or less equal consideration of both OHS and environment, with neither dominant;
- well-understood problems and opportunities;
- well-defined staff responsibilities;
- well-qualified and motivated staff;
- well-defined procedures to involve relevant experts;
- emphasis on prevention at source.

There is also scope for the integration of quality management into HSE systems. While this appears to be done rather irregularly, there are firms who are managing through fully integrated

systems as indicated by the AMEC example in the box below (Carter, 2000). In theory (Stares, 1997, Zwetsloot and Bos, 1998, Carter, 2000), integration of management systems should bring a number of benefits including:

- synthesis of ideas across different management areas and a clearer view of the 'big picture';
- efficiency improvements through reduced duplication of effort in terms of hazard identification, development of procedures and controls, auditing, etc.;
- reduced competition for resources;
- better internal communications and management integration;
- 'cross-learning' between disciplines/departments;
- consistency of approach.

Integrating HSEQ in civil contracting

AMEC Process and Energy is a leading contracting company working in the strictly controlled offshore oil and gas industry. In order to set itself apart as a market leader, reduce costs and facilitate interfaces with customer and sub-contractor management systems, AMEC decided to develop an integrated health, safety, environment and quality system. From 1996 to the end of 1999 the company built on its existing ISO9001 system and its less formal HSE systems to produce a fully documented HSEQ system, compatible with ISO9001, ISO14001 and the draft OHSAS 18001. It is anticipated that future integration will involve joint audits by assessors. The company sees the key success factors as being:

- clarity over plans of action and areas of ambiguity;
- strong lines of communication between key individuals;
- use of joint contractor/client implementation teams.

It is also worth noting that the implementation of OHS and EMS management systems could bring other benefits, for example in terms of:

- less frequent regulatory inspections and reduced reporting requirements;
- in some Member States, no legal obligation to use OHS services/experts;
- reduced insurance premiums (public or private);
- preferential treatment in tendering for public sector contracts.

The extent to which such approaches are used as an incentive to the adoption of management systems is not clear, although Zwetsloot and Bos (1998) note that there appear to be few examples. It is finally worth noting that integrated management systems can also bring efficiencies for the regulators. Norway for example has benefited from joint HSE inspections resulting from its Internal Control Regulations.

But what is the position in terms of fully integrated sustainable development systems? It appears that very few systems are under development although there is one in the UK called Project SIGMA (Sustainability: Integrated Guidance for Management). This aims to bring together all strands of sustainability within one performance-based framework using existing tools and approaches without making the system too complex. The project is being supported by the UK DTI and involves the UK standards institute, the BSI. The project is being developed with the assistance of various pilot companies and ultimately it is intended that the system will be developed into a full standard.

Reporting and accounting

As noted earlier, companies that examine their own operations in some detail often benefit by identifying and correcting problems. Reporting frameworks, involving the use of key measures and indicators, offer companies a way of identifying and tracking the key problems. They also allow stakeholders to monitor progress. As noted earlier in this report, environmental reporting is now quite common although there are few national reporting systems and no EU or ISO standard. In those countries, such as Denmark, which make environmental reporting obligatory for certain companies, certain information has to be provided and guidance is given.

It is worth noting that the UK Environmental Audit Committee (part of the parliamentary process) this year called for obligatory reporting for companies with more than 250 employees in the UK, changes to UK Company Law (which already make financial reporting compulsory) offering one way of making this happen. The committee noted, however, that only a small number of parameters should be mandatory to allow for innovation in reporting to take place. It has also been suggested that a simpler reporting requirement should also be placed on SMEs. It is worth noting that those companies that fall under IPPC in the UK will also have to provide information for the Environment Agency's pollution inventory.

In terms of SD reporting, the first comprehensive guidance on reporting is now being developed under the auspices of the Global Reporting Initiative (GRI), making use of environmental, social and economic indicators, while the Dow Jones Sustainability Group Index (DJSGI) also offers some means of assessing relative performance. GRI, which has the support of UNEP and various world NGOs, is an important development that aims to make sustainability reporting credible and universally consistent. Clear and comprehensive guidelines were released in March 1999 and are currently being piloted. These aim to:

- provide stakeholders with reliable and relevant information that fosters dialogue and enquiry;
- provide well-established principles to allow consistency;
- facilitate reader understanding and comparison with other reports;
- provide information to enhance internal decision making.

It should also be noted that DG Employment at the European Commission is developing Corporate Social Responsibility (CSR) reporting guidance that covers social and environmental parameters and which will hopefully lead to an EU standard in the area.

The Dow Jones Sustainability Index

In this context it is important to note the Dow Jones Sustainability Group Indexes (DJSGI) which aim to identify the top 200 'sustainability-driven' companies from the top 2,000 stocks in the DJ global financial index. The assessment focuses on a company's pursuit of sustainability opportunities – e.g., meeting market demand for sustainable products and services – and the reduction, ideally avoidance, of sustainability risks and costs. While useful, it must be remembered that the index is based on a subjective judgement by consultants using information provided by the companies themselves on such things as policies, management systems, auditing and reporting, stakeholder consultation, etc. rather than absolute performance data in terms of wastage, emissions, energy usage, etc. Of the 18 top companies listed in the index (2 for each of 9 industry groups), 6 are from the EU, including Sweden, Finland, the UK, Netherlands (Unilever), Germany and France. It is worth noting that even the top company in the index, Bristol-Myers Squibb, a US Pharmaceuticals company, while doing well in several areas, obtained poor marks in various important areas including environmental accounting, impact of products, minimisation of energy, water, packaging, etc.

It is clear that mandatory requirements in particular make companies conduct the sort of transparent self-analysis and auditing that is necessary. It is worth noting, however, that whatever the reporting framework, some sort of external validation should be mandatory as with financial reports. This should not only help to improve the quality of reports but also allow companies to learn more about their monitoring and reporting procedures and its efficacy. Under a new bill now passing through the Danish parliament, mandatory environmental reports will be reviewed by the regulatory authorities rather than consultants (Ref. ENDS Daily, 23/10/2000).

It is worth noting that 'green' accounting approaches allow environmentally-related costs and benefits to be included as part of the regular accounts. As such it has to deal with consideration of material and energy flows (including emissions and wastage) and can involve the use of LCA techniques, monetary valuation of impacts, etc. The idea is that environmentally related costs and benefits become more transparent to the decision-makers at the higher levels of management which in turn allows them to be taken into account, for example in relation to investment appraisal. Clearly maintaining green accounts and other relevant databases also facilitates compliance reporting and more general corporate reporting. As yet there is no ISO standard in relation to green accounting although there are many examples of practice.

Finally it is worth noting that health and safety considerations must not be forgotten both in terms of reporting and accounting.

Life cycle assessment and other tools

Life cycle assessment (LCA) is now a widely used tool in such areas as eco-labelling assessment, the eco-design of products and (increasingly) in policy areas, particularly waste management. In theory LCA should offer a rigorous assessment of the environmental impacts of a process or product from cradle to grave. Unfortunately LCA has a number of problems associated with it, particularly in the sense that impact data is often:

- out of date (e.g. relating to obsolete processes and procedures);
- based on hidden assumptions;
- extremely uncertain, particularly with regard to toxicological effects[12];

LCAs also often leave out certain impacts, for example those related to material extraction or those that are avoided (e.g. benefits gained from recycling through reducing the impact from energy generation). Neither are OHS considerations always addressed. Some of the modelling issues have been dealt with to an extent by the international standards on LCA, ISO14041 to 43 However, there remain numerous problems.

LCA approaches, for example cannot easily address qualitative effects such as landscape impacts and other amenity issues. Given that we may be dealing with a very wide range of impact parameters, typically covering resource use and emissions to air, water and land, it can also be very difficult to compare one process or product with another. This is particularly true for a designer or member of the public with no environmental expertise. In any case, how does one compare a process that is good on CO_2 but poor on NOx with one that is the opposite? Some ways around this include monetary valuation of impacts, scoring and weighting approaches and the 'ecological footprint' approach which converts certain key impacts into land area (e.g. amount of forested land to absorb so much CO_2 or provide so much energy). While these approaches 'normalise' the results to allow direct comparison, they add a further layer of uncertainty and subjectivity.

While LCA is therefore often presented as a rational decision-making tool, it can lead to very misleading and often subjective conclusions being drawn. As a result some commentators (such as SETAC-Europe and the Science Policy Research Unit at Sussex University) now suggest that LCA should be used as a way of exploring issues and raising awareness rather than a means of determining whether A is better than B. Certainly when it comes to policy formulation LCA should only be used as part of a wider decision-making framework which takes all stakeholder concerns into account.

Various other tools exist to assist product design. These include 'innovation' tools such as quality function deployment (QFD), which helps companies to develop specifications from customer or

[12] This by as much as a factor of 1000, according to a recent TNO report (ENDS Report, June 2000).

consumer preferences. SMEs, however, often benefit from simpler approaches, for example principles, criteria and checklists of dos and don'ts. While such tools are in theory less accurate than LCA-based tools, they at least offer a transparent and simple approach that SMEs can understand and readily use. Criteria and benchmark targets for SMEs, for example noting the level of recycled material that should be aimed for in a certain product, can in any case be derived using sophisticated LCA tools as a guide, to ensure that the general requirements are in the right ball park.

The JRC report on eco-design (JRC, 2000) suggests that to be effective, the eco-design toolbox has to at least include:

- standardised and up-to-date databases and easy-to-use software tools;
- manuals with appropriate procedures;
- simplified tools (e.g. checklists, protocols) that are aimed at:
  - specific products or sectors;
  - SMEs and other companies with limited resources.

In this regard it will be interesting to see what comes out of the ISO process, guidelines on eco-design being currently developed.

Eco-labels and declarations are clearly useful tools for those in industry wishing to 'green' their operations. However progress has been slow since the full pass/fail approach, using sophisticated LCA methods, is time consuming and can be contentious. It appears that there is a need to accelerate the whole process and make it more 'inclusive', i.e. suitable for all products within a group, not just the very greenest. Criteria could be developed on the basis of best practice in a product group and products then given a score (e.g. on a scale of 1 to 5) against each relevant criteria for the group. Eco-innovation awards could be utilised to stimulate action and help establish best practice.

Chapter 7 Conclusions and recommendations

The report has attempted to bring together a diverse range of work under various projects within the Foundation's sustainable development programme. The report has covered many issues and illustrated them with various examples from across the EU. Given the complexity of many of these issues it is inevitable that the following conclusions have to be quite general in nature. We would therefore strongly recommend that those reading only this section refer back to the main body of the report, and relevant references, with regard to points of particular interest. In addition we would draw attention to the work of the European Science and Technology Observatory, ESTO (part of the EU Joint Research Centre), which has recently published work on *'Eco-Design; The state of the Art in Europe'* and is soon to publish a report on *'Eco-Design; Strategies for Dissemination to SMEs'*.

Progress towards a sustainable future

The evidence suggests that a significant, but small, proportion of the larger EU companies are making good progress towards more sustainable modes of operation. These larger companies are very important in that they account for around 35% of the total employment and probably over 40% of the total waste and pollution. Most, however, have a good health and safety record and ensure compliance with environmental regulation while a significant and increasing proportion have an EMS (EMAS or ISO14001) in place and produce an environmental and/or health and safety report. Many have already made eco-efficiency improvements, while a smaller group have embraced such concepts as eco-design, green purchasing and green accounting. A few companies are fundamentally changing their approach to manufacturing, for example investing seriously in the use of renewable resources (e.g. non-food crops) and looking carefully at their social and ethical responsibilities, both locally and globally.

These large companies, however, represent less than 1% of the total number of enterprises, over 99% of companies being SMEs and around 93% being micro SMEs (less than 10 employees). Collectively these SMEs account for around 65% of total employment and probably over 50% of the waste and pollution. While the evidence is somewhat inconclusive in relation to working conditions, SMEs do not appear to perform well in relation to the external environment. The vast majority of companies have done very little in terms of voluntary action while many SMEs even fall below regulatory thresholds.

In terms of environmental expenditure, survey work suggests that small and micro SMEs spend a disproportionally small amount relative to their turnover. In terms of environmental management systems, SMEs probably account for fewer than 25% of around 10,000 EMS registrations, i.e. only 2,500 out of approximately 18 million SMEs across the EU! Even taking into account the fact that many micro and service sector SMEs have very small or negligible impacts and that there are many companies with an unofficial EMS, it is still likely that fewer than 5% of companies that would benefit from an EMS actually have one. Involvement in eco-efficiency and other support schemes is also in the tens of thousands across the EU rather than millions. While there are good examples, very few SMEs as yet have got involved in eco-design and more advanced SD concepts.

We can safely say, therefore, that progress is very slow. In fact, in terms of certain parameters economic growth is surpassing the gains that are being made in resource efficiency terms. But why is this? There is, after all, a long-standing regulatory framework, at least in relation to health, safety and environment and some use of economic instruments. The evidence shows that activities to improve the internal (working) and external environment, such as eco-efficiency and eco-design work, invariably improves competitiveness and profits, for example through reducing operating costs and developing new markets or better market share. There is also no shortage of vocational education and training courses, support initiatives (particularly for SMEs) and tools, with a very large number across the EU covering most of the key issues.

So what is the problem? The answer lies in the numerous and sometimes complex barriers that exist in relation to company (and in particular SME) resources, competencies, awareness, motivation, culture (attitudes) and structure. These barriers are clearly important if they are to be overcome and hence are repeated (from Chapter 1) in the box below.

Key barriers to SD improvements in manufacturing and commercial SMEs

Resources and capabilities

- lack of time/staff resources for investigation (e.g. pilots) and implementation;
- lack of financial resources (mainly capital) for investigation and implementation;
- lack of required technical skills and knowledge (competencies);
- lack of ‘risk-assessment’ and investment appraisal competencies.

Awareness and motivation

- lack of awareness/understanding of the problems/issues themselves;
- lack of awareness of better processes/product designs and other potential improvements;
- lack of clear regulatory drivers and awareness of those drivers that exist;
- lack of clear economic incentives in some cases;
- lack of awareness of the true benefits (e.g. cost savings) of improvements;
- lack of awareness of competency/skill needs;
- lack of awareness of available tools and techniques;
- lack of awareness of support and its value.

Management culture and structures

- lack of strategic and holistic thinking;
- lack of goals and targets;
- inadequate cost accounting systems;
- poor attitudes to investment and risk (e.g. economic ‘short termism’);
- inadequate internal company communication and functional integration;
- inadequate external communication, even with customers and suppliers;
- inflexible company culture and resistance to change;
- lack of leadership and management commitment;
- lack of employee involvement.

In many cases the barriers are those that prevent innovation in general and it is important to note that stimulating and directing commercial innovation has to be central in the drive for more sustainable manufacturing. So what are the processes and success factors that can take us more quickly towards this paradigm? This is clearly not an easy question to answer, however one can say that a range of approaches and measures, combining certain elements of pressure, motivation and support, will have to be used in a more co-ordinated and determined way. The sections below deal with these various elements in relation to both the internal and the external factors that affect company behaviour.

Internal processes and success factors

It is clear that companies, both industrial and commercial, have to address a number of issues if they are to innovate and progress towards a more sustainable position. They have to look inwards and outwards and manage change effectively. The following key areas need to be addressed.

Taking an analytical, continuous improvement approach

Perhaps the most important thing that companies can do is take a self-critical and methodical approach to performance analysis and continuous improvement. While systems such as ISO14001 offer useful frameworks, it is increasingly accepted that they alone do not necessarily lead to improvements. The monitoring of actual performance is the critical thing and procedures need to be in place to ensure that companies regularly examine such things as working conditions, resource use, waste and pollution, stakeholder concerns, etc. alongside 'normal' parameters such as productivity, turnover and profit. They also need to compare themselves with peers through 'benchmarking' exercises.

Identifying key indicators, gathering data, analysing that data, looking at the options, producing an action plan (complete with short and medium term objectives and targets), implementing that plan and reviewing it, are all important stages in a closed continuous improvement 'system'. In examining options it is vital that the commercial and wider costs and benefits of improvements, including the hidden and indirect ones, are identified. These can then be clearly presented to decision-makers and used in investment appraisal processes to establish the payback and gain commitment to change. Keeping 'green accounts' can help to keep track of progress and make the issues clearer, in particular to those in senior management.

Appropriate systems and tools should be used to improve the quality and usefulness of the data that is gathered and facilitate its use. More is said on this subject below.

Taking an integrated and 'stakeholder' approach

Separate measures, for example in relation to OHS, waste minimisation, eco-design and so on, can and do move companies forward. However, to make real progress requires an integrated view, cutting across topics and functions. Dealing with health, safety, environment and quality together, for example, can overcome conflicts, lead to synergies and reduce overall workload. Environmental and social considerations should be an integral part of most if not all functions, including design (where they should be considered from the start of the design process), purchasing, finance (investment), marketing, etc. as well as manufacturing itself. Social and environmental considerations should become integral to good business practice.

Sustainable 'design' of processes and products therefore requires good internal communications, ideally involving multi-disciplinary improvement teams. It should therefore also involve training to improve staff competencies accordingly. It should also involve careful consideration of those stakeholders outside the company, in particular suppliers, customers and consumers. This is particularly the case with product design, which of course should not only deal with impacts related to the manufacturing process itself but also those that are upstream (e.g. material extraction) and downstream (use) of it.

Staff involvement and motivation

Involving staff in improvement programmes, from management down to 'unskilled' shopfloor operatives, is important both in terms of gaining staff commitment and in terms of making use of

their often valuable (and often ignored) experience. There is certainly a place for 'bottom-up' initiatives, perhaps involving trade union representatives or works councils, as well as the more normal 'top-down' management-led approaches (see case study in Annex 1). In terms of the latter in particular, it is essential to have a co-ordinator or 'champion', a staff member who can develop certain competencies and act as a team leader and mentor. Rather than working in isolation, the co-ordinator should work as part of a multifunctional team as noted above. The co-ordinator should ideally be someone who:

- has a personal commitment to environmental and SD issues;
- has influence with senior managers;
- understands the various aspects of the companies operations;
- has, or can gain, the respect and co-operation of those on the shopfloor;
- is a good communicator and motivator;
- has sufficient resources allocated (time, extra staff).

It is also important to foster staff interests and carefully plan staff training so as develop competencies in line with the operational and more strategic goals. Improving staff awareness of SD issues, for example, can usefully be made an objective that the employer and employee should meet.

Looking outward – developing external networks

Companies that want to innovate and move towards a more sustainable future have to look outside their own organisations and sectors for advice, assistance and inspiration. They need to network widely and actively search for information (e.g. case studies), guidance and new tools. Three key networks can be developed and utilised;

- business networks, including supply chains, banks, insurers, etc.;
- regulatory networks, including local authorities and other agencies;
- knowledge networks, including the above but also many other bodies such as NGOs, universities, other local companies, etc.

Supply chains, both customers and suppliers, are particularly important as they can be sources of assistance as well as pressure. Working with them can therefore bring better practice and better commercial relations. Being open, taking part in local business clubs, support initiatives, etc. is also invariably helpful. SMEs in local and sectoral networks often gain from sharing experiences with others. Working with local communities on social, economic and environmental development projects can also be beneficial from the company perspective, for example in terms of reducing local opposition to planning applications and improving the company's position in the local labour market.

Taking a strategic, long-term view

It is important to plan strategically, looking to the medium-term and the long-term (perhaps 20 years or more) to identify future threats and opportunities, not just in terms of regulatory and market trends but in terms of the underlying sustainable delelopment issues. For example, companies (and indeed society as a whole) need to look ahead to a time when non-renewable resources will be scarcer and more costly than renewable ones. They need to consider 'visions' of this future, which will of course be somewhat uncertain, and work back (backcast) to establish what they need to be doing in the short and medium-term to adapt to that future situation.

Companies need to be imaginative, 'open-minded' and flexible, to come up with potential solutions which overcome cultural momentum and narrow-mindedness. They need to set short and medium-term targets that will take them towards that longer-term goal and appropriate investment decisions (for example in relation to capital purchases, staff training, etc.). While commercial pressures often dictate a quick return on capital invested, such 'short-termism' can virtually eliminate certain more strategic opportunities. Companies have to be prepared to take considered risks and experiment, for example through small pilot projects.

External success factors

The policy framework and market mechanisms

The policy framework and market conditions in which companies operate, in terms of legislation, voluntary agreements, economic instruments and other market factors, obviously have a huge impact on company behaviour. Regulations across the EU generally aim to achieve a minimum standard, often in terms of end-of-pipe concentrations, but seldom provide incentives for further improvement and innovation, for example in terms of resource efficiency improvements and the use of inherently less harmful materials and processes. Unfortunately, market mechanisms do not generally take into account the full environmental and social impact of activities, i.e. they fail to 'internalise externalities' to use the language of the economists.

As Zwetsloot and Bos note in the Foundation's report, *Environmental Management and Safety and Health* (1998), policy frameworks therefore need to include a basic legislative framework complemented by a range of voluntary instruments and economic instruments that provide suitable incentives. Whatever the instruments, they need to be reasonably well harmonised across the EU and fully justified on environmental grounds to avoid challenges on trade barrier grounds. Product-related instruments will also need to be backed and elaborated by appropriate technical standards.

Regulation and standards

Regulation, involving either legislation or voluntary agreement, needs to set good minimum standards to meet clearly defined and if necessary precautionary objectives. However it needs to take into account the circumstances of SMEs and of specific sectors in doing so. In terms of the former, regulation needs to be as clear and simple as possible and less demanding in terms of the administrative aspects of compliance if not in terms of the actual limits set. There is also a need

to increase integration with respect to sustainable development, or at least design it to be compatible with other relevant regulation, for example link OHS legislation more closely to environmental legislation. Sector-specific (such as the new IPPC BREFS) or even product/material-specific guidance notes could be used to draw together information covering a range of legislation to make it more accessible. The EU Integrated Product Policy (IPP) process also needs to ensure that the health and safety aspects of products (e.g. use of hazardous materials) are carefully taken into account.

Regulation also has to be even-handed, with all producers (or at least a large majority) taking a fair share of the responsibility and cost (Polluter Pays Principle) and free-riders being largely eliminated. Sanctions have to be a major deterrent for those who fail to comply, large fines and custodial sentences being the obvious approach, enforced improvement (e.g. equipment modernisation) an interesting alternative. Importantly, regulation should play a major role in encouraging innovation and providing improvement incentives, for example through allowing eco-efficiency routes to compliance or different inspection regimes based, for example, on whether a company has an accredited EMS. It should also require self-analysis and reporting since forcing companies to look at their own operations is an important step towards positive change.

Recent producer responsibility/take back regulation in the EU has satisfied many of the above conditions and further legislation of this type would certainly be helpful. Voluntary (negotiated) agreements could also be used more widely so long as they are backed by the threat of significant sanctions or strict legislation. The forthcoming EU IPP is an interesting development in that it will hopefully help to provide a coherent policy framework in which more product-oriented environmental policies will develop. This will allow the more consistent and comprehensive development of information initiatives, such as eco-labelling, further producer responsibility/take back regulations and other measures targeted at eco-innovation and market development. It may even be that EU-wide voluntary agreements can be developed, for example in relation to the performance (e.g. recycled content) of key products.

In terms of corporate reporting, it seems to make good sense to require all medium and large companies across the EU to report on their environmental and social performance, to clearly defined standards, as required for many companies already in certain Member States. While it is unreasonable to expect full reports from smaller SMEs, they can be required to report on certain performance parameters (as many will be under IPPC) and adopt the EPE standard ISO14031 to provide some consistency. As noted above, measuring and reporting on performance is at least as important as having a management system (such as ISO14001) which primarily puts procedures in place.

Finally one can say that there is a good argument for making basic education and training, the use of certain support services and/or the membership of certain support bodies, mandatory across the EU as it already is in certain Member States such as Denmark (the new law on

Environmental Training for Employees) and Germany (e.g. membership of local chambers of commerce). Compulsory OHS training has, after all, had a very positive impact.

Market mechanisms

Market conditions are obviously crucial in determining company behaviour and market mechanisms should therefore be used to the full to encourage appropriate responses. Economic instruments (EIs), in the form of taxes and charges in particular, offer a cost-effective way of internalising external costs and allowing the market to find an optimal level. It is clear that there is much greater scope to use EIs both in the environmental field and in the OHS field, for example through the use of differential taxes/insurance premiums and deposit-refund schemes, particularly in Member States where charges do not even reflect the private costs.

The challenge here is to identify where they can most effectively be applied and how taxes can be designed to overcome potential barriers. Hypothecation (earmarking) of taxes for specific environmental and social uses, making them revenue neutral overall, is one way of making them more acceptable to industry and the general public. As with other instruments, the environmental case has to be clearly made to avoid challenges with regard to barriers to free trade. There are also other important market mechanisms that can be used. Pressure from customers, both in the private and public sector, and from banks, insurers and consumers can all be significant drivers of action. While influencing private sector and consumer behaviour is obviously difficult, awareness raising and targeted support can be effective. Public sector 'power' is more readily manipulated by policy makers and it is clear that 'green' and ethical procurement and conditional funding could be applied far more extensively across the EU. It is also worth emphasising that new (start-up) enterprises can perhaps best be influenced by funders and more should be done to use such funders to disseminate information and apply pressure.

It is also clear that stakeholders should be involved (at least consulted) in the development of regulation and other policy instruments so as to ensure their efficacy and fairness. The social partners obviously have a crucial role here. The employer organisations can help to ensure that the instrument is practicable and even-handed from the business community perspective while the trade unions can ensure that the instrument addresses such issues as working conditions, workplace democracy, etc.

Education, training and support systems

Education, training and support provide the opportunity to influence company and staff behaviour, enhancing and complementing the impact of the regulatory and market mechanisms noted above. As already discussed at length, there are however a significant number of problems that exist, particularly in relation to current provisions and their delivery to SMEs. SMEs are, however, not a homogenous group. They differ in particular in relation to what they do (sector), the context in which they operate (economic, policy, cultural, etc.) and their size, small and micro SMEs being somewhat different to medium-sized SMEs. While SMEs largely experience the same barriers and respond to the same motivations, education, training and support provisions have to be flexible and tailored to meet quite specific needs.

Planning of support is critical and has to be based on a genuine understanding of short, medium and long-term needs (relating to clear SD goals) and specific company or at least sectoral needs. It should be noted that one should be trying to pass on skills and knowledge, developing competencies within firms at various levels, often training/supporting the trainer/co-ordinator. In general one can say that those with specific environmental and/or OHS responsibilities, while not needing specialist degrees, do need quite specific, detailed and practical information across a range of topics. Much more is said about education and training in the Foundation's consolidated report on *Professional (vocational) Education and Training for Sustainable Development.*

In general terms support initiatives/provisions must:

- cover a wide range of topics, going way beyond regulation and EMS;
- carefully focus on the most damaging sectors and those with the most potential;
- make sure that provisions are made for 'new enterprises';
- use genuine sector/subject experts (avoiding superficial advice);
- use sector-specific material and tools where possible;
- use SME-specific material and tools, i.e. those that are concise, simple, quick and low-cost;
- involve 'active' support, which 'interacts' with companies through the improvement process;
- provide the longer-term support to allow the transition to be completed.

Clearly appropriate funding has to be provided to support these activities, both in terms of research and development and demonstration and implementation.

Initiative design

In terms of topic coverage, there has to be much more emphasis on such topics as eco-efficiency, eco-design, green purchasing, green accounting, integrated approaches (for example covering health, safety, quality and environment) and 'sustainable manufacturing' approaches (e.g. based on renewable resources, dematerialisation, etc.) All such initiatives should aim to include stakeholders and deal with their social as well as their environmental concerns. In this respect it is worth noting that 'environmental' projects can have social goals, for example in relation to community and workplace democratisation.

In sustainable development terms, what is really required is a balanced and integrated approach that takes into account all aspects as appropriate. Having said that, fully integrated concepts can be complex and off-putting, particularly for SMEs, most of which are still far from conversant with concepts such as waste minimisation which have been around for over twenty years. While it is important to introduce new and often difficult concepts into SMEs, this has to be done very gradually, one issue at a time, slowly building up a complete and more holistic picture.

Some initiatives should be designed to work top-down, through management, complementing others that should be designed to work bottom-up (i.e. from the grass roots), through non-

management employees including shopfloor and clerical staff. The former should involve a key management co-ordinator, working with a multi-functional team. The latter can be achieved through works councils and shop stewards, although one has to accept that such approaches will not be available in the majority of smaller SMEs. In this respect there is something to be said for trying to reach workers through the staff development/HR mechanisms and through their children via school programmes.

High-quality, low-cost support

So as to ensure high standards of support and training, and to give confidence to SMEs selecting services, accreditation is useful. There may even be merit in having national registers of accredited advisors, although the criteria used would have to be carefully determined. Trainers and other support providers really need strong practical experience, particularly in the relevant sector/s, and good communication skills as well as competencies in the subject area. Being able to speak the 'business language' should be a pre-requisite.

Retired staff from industry and environmental bodies can be utilised to bring extensive experience at relatively low cost. At the other end of the spectrum, newly qualified graduates can be used to help firms carry forward improvement projects. While such young people rarely have much business or sectoral experience, they should (if chosen carefully) have good and recent subject knowledge, for example in relation to EMS or waste minimisation. As such they can offer an extra 'pair of hands' to gather and analyse data, explore costs and benefits of improvement options, etc. In this way the company gets a low cost resource that complements the firm's knowledge of its own business and processes. Often this leads to companies making significant improvements whilst saving enough money to give the graduate a full-time job. It should be emphasised that such graduate placement schemes are best used to supplement, rather than replace, 'expert' mentoring.

Coordination and partnership

Provisions also have to be carefully co-ordinated on a regional or sub-regional basis, to reduce the number and duplication of initiatives and improve design and promotion. Delivery should be through local/regional networks/partnerships with a single and clear point of contact for local companies. Initiatives should be carefully promoted to key-decision makers in companies, emphasising the commercial benefits. Without his or her commitment nothing is likely to happen. 'Gatekeepers', for example influential and well-connected individuals in large firms, local authorities, etc. can be useful in identifying the key people and in promoting initiatives.

Sectoral approaches, driven by trade (employer) organisations or through supply chains (mentoring), can be particularly effective, even with regard to smaller SMEs. While not a panacea, supply chain initiatives can be particularly effective where the supplier network is reasonably accessible, i.e. predominantly within the same region. There is something to be said, therefore, for supporting trade (employer) organisations and large companies to support their supply chains, so long as these large companies are accountable and properly monitored. It is

worth noting that sectoral approaches can also mesh with regional and local initiatives, providing specific support for key sectors in that region.

Joint social partner initiatives are also helpful in that they bring a more coherent and consensual approach suitable for companies as a whole. As such they can train, motivate and empower those on the shopfloor as well as those in management and clerical jobs. In other words they offer a useful way of bringing top-down and bottom-up measures together, avoiding the potential conflicts that can otherwise occur (see case study in Annex 1).

Management systems and support tools

Management systems and support tools are now quite widely available both on paper and in their electronic forms, covering everything from EMS and OSHMS, through eco-product design using LCA, to environmental and social responsibility reporting frameworks. While it is good to have a range of innovative tools, including some specifically designed to provide step-by-step approaches for SMEs, the picture can be complex and confusing. In parallel with what needs to be done in terms of support initiatives, there is a need to provide systems and tools that:

- are practical, low-cost and simple to use;
- are transparent, particularly in terms of inherent assumptions;
- increase integration across topics (e.g. OHS and environment), to reduce user workload and to take advantage of synergies;
- provide consistent, high quality, up-to-date information;

There is also a need to limit the number of systems and tools and the duplication and overlap between them to make their capability and value clear to potential users. International standards, for example the recent ISO14031 environmental performance evaluation standard and ISO14041 to 43 for LCA, are very helpful in this regard. Well-defined and nationally/internationally agreed indicators and reporting frameworks, such as GRI and the DJSGI, are also clearly helpful as will be the forthcoming CSR reporting guidance from the European Commission. The UK SIGMA project (Sustainability; Integrated Guidelines for Management) is also set to provide a much more comprehensive management framework that truly encompasses all dimensions of sustainable development.

In terms of eco-design and green procurement there is a real need to accelerate progress by providing simpler tools and guidance. Standardised and ‘inclusive’ eco-declarations really need to be developed to complement existing but ‘exclusive’ eco-labels. While such declarations may be less than perfect they can at least help companies, particularly SMEs, make more informed decisions.

Recommendations

The recommendations here are wide-ranging and quite general in nature. It should be noted that they reflect the opinions of the author and not necessarily those of the European Foundation for

the Improvement of Living and Working Conditions. Note also that more-detailed recommendations with regard to vocational education and training for SMEs and the use of economic instruments are made in the complementary reports on these subjects from the Foundation.

Recommendations at EU/multinational level

- make greater use of existing data, and where necessary conduct new research, on the relative importance of SMEs (in particular small and micro companies) in manufacturing and service sectors to the overall environmental load (resource use, waste, pollution, etc.). This information should be used to improve the design of policy instruments and support initiatives;
- ensure that future policy instruments provide for adequate baseline protection but also allow appropriate incentives, through commercial and wider benefits, to encourage further voluntary improvements and innovation. Policy instruments should be flexible to allow Member States to adopt appropriate solutions (for example making used of EIs, VAs, etc.) that meet their particular circumstances and allow suitable allowances to be made for SMEs;
- ensure that further work continues in relation to an EU Integrated Product Policy (IPP), taking account of health and safety aspects of products alongside environmental aspects. In this context, wider use of voluntary agreements (e.g. on recycled content of products), economic instruments and producer responsibility legislation should be considered to satisfy the Producer Pays Principle and importantly to improve supply chain interactions and self-analysis within companies;
- ensure that work continues within the EU (adopting national systems as a basis where appropriate) and beyond (ISO) to improve the harmonisation, coverage, compatibility and ultimately the integration of systems and standards. This work should cover such things as management systems, tools, corporate reporting frameworks and perhaps such things as standards for vocational training courses, SD business advisors, etc. Particular attention should be given to the development of EU-wide and standardised guidance and tools for SMEs (including small and micro companies), for example in relation to eco-design and procurement;
- ensure that further research is undertaken to gain a better understanding of the role and potential for supply chain initiatives across the EU, particularly in respect of eco-efficiency, eco-design and green-procurement. At present the use of both supply chain pressure and mentoring seems under-utilised.
- ensure that green public procurement is applied where possible at the EU level and encouraged at the Member State level;
- ensure that further research is conducted to clarify the conflicts and synergies between environmental and OHS effects. This information should feed in to the design of more integrated tools (e.g. LCA) and systems;
- ensure that research and development in the field of fundamentally new and truly sustainable approaches to production and consumption, based on long-term goals, are pursued through existing programmes (e.g. the 5th Research Framework Programme, LIFE, etc.) and future programmes. This research should at least in part look at localised production and consumption to create truly sustainable and largely self-sufficient communities;
- ensure that extended support for transnational working and other forms of best practice dissemination for industry is given through programmes (such as ADAPT, LEONARDO) and networks. One suggestion here is a promotional network, similar to the OPET energy

network, but dealing with best practice in relation to eco-efficiency, eco-design/procurement and more sustainable manufacturing in general. This could make use of information from national programmes such as the UK's ETBPP, the Dutch EET Programme, the Swedish eco-design Programme, etc. In particular, establish and encourage support networks (preferably EU-wide) dealing with good practice dissemination to SMEs (including small and micro companies);

- ensure that guidance is given to Member States in relation to company competency requirements for SD and the delivery of education, training and support, highlighting the key success factors as presented in this report;

Recommendations at Member State/regional level

- develop future legislation and other policy instruments so as to take account of SME-specific and sector-specific circumstances, where possible providing for commercially beneficial approaches to compliance (e.g. resource/pollution reduction approaches) to stimulate innovation and voluntary improvement;
- make greater use of carefully designed economic, voluntary (negotiated) and hybrid instruments, both in the environmental field (e.g. resource use, use of hazardous materials) and social fields (e.g. OHS, democratisation). Revenues from EIs should, wherever possible, be hypothecated (earmarked) with regard to relevant SD funding and support programmes;
- make greater use of integrated policy instruments where possible, for example bringing together OHS and environment;
- develop green and ethical public-procurement programmes, to stimulate demand for more sustainable products;
- develop and encourage 'conditional' funding programmes, in the public and private sectors, that require SMEs and new start companies to achieve certain standards (e.g. ISO14001, eco-design work) and make use of commercial and technical guidance;
- introduce full mandatory performance-based SD reporting for all medium/large enterprises and more restricted reporting (limited to a few key parameters) for a wide range of smaller companies, beyond those falling within IPPC;
- encourage the greater use of performance-based systems such as ISO14031 and continuous improvement approaches such as the Dutch Branch Code Path approach for small companies;
- encourage stakeholder participation in policy development at local, regional and national level, including the social partners, local authorities, NGOs, community representatives, etc.;
- put in place national strategies for vocational training and support in the field of environment and sustainable development. These would ensure such things as:
  - proper coverage of a wide range of themes and topics;
  - integration of SD topics into 'regular' course curricula;
  - geographical coverage proportionate to need;
  - proper regional coordination, with comprehensive partnerships and clarity of roles;
  - appropriate standards and registers of accredited courses and trainers;
  - consistent use of best practice across the regions.

- support the development of more integrated tools and systems which fully take into account OHS, quality and wider SD issues and criteria.
- encourage the development of national commercial and industrial support programmes, providing tools, guidance and funding, across all Member States, covering as a minimum eco-efficiency, eco-design and integrated approaches (e.g. environment with OHS and quality). Subsidies and funding should be particularly targeted at helping new-start companies and smaller SMEs to participate in schemes, conduct pilot trials etc. so as to allow them to overcome some of the resource barriers that they face;
- encourage and support the establishment of clear and 'branded' provider networks, with regional and local nodes, to improve coordination and clarity for SMEs. These networks would involve key regional partners (e.g. local authorities, regional development agencies, NGOs, large companies, etc.) and sectoral partners (e.g. employer associations and trade unions) and offer a one-stop-shop for SMEs.;
- promote initiatives to companies primarily in terms of commercial rather than social or environmental benefits, using carefully chosen 'business language';
- make greater use of supply chain initiatives and partnerships, in terms of mentoring and leverage, where necessary providing public support for larger companies to enable this activity;
- make regionally-based training and support systems stronger through adoption of best practice as highlighted in this report, i.e.:
  - careful planning based on a genuine understanding of SME needs and SD goals;
  - topic integration, e.g. combining health, safety, environment, quality;
  - careful targeting – key company managers, works councils, etc.;
  - involvement of cross-functional company teams, led by a 'champion';
  - use of genuine sector/subject experts to provide advice/mentoring;
  - use of sector-specific material and tools where possible/appropriate;
  - use of SME-specific material and tools – concise, simple, quick and cheap;
  - use of 'active' support, which 'interacts' with companies through the improvement process;
  - provision of longer term support to allow the transition to be completed;
- make greater use of graduates and retired people to provide low-cost, extended and hands-on support to SMEs, supplementing consultancy/expert advice;
- encourage and support increased and joint activity of the social partners, particularly with regard to:
  - trade (employer) association sectoral programmes;
  - trade union programmes for members;
  - supply chain initiatives and partnerships;
  - joint initiatives;

- increase the use of policy instruments, for example legislative and economic instruments, to ensure (or at least strongly encourage) uptake of support initiatives, particularly in relation to:
  - improved SME participation;
  - staff competency improvements;
  - improved worker involvement;
- encourage greater awareness and use of standards for training and trainers and the use of national registers of appropriate individuals.

Recommendations for companies

- be 'open-minded' and flexible with regard to new ideas;
- plan strategically, taking a long-term SD view and backcasting to set targets and plan short and medium-term actions;
- take an integrated view of problems, cutting across topics and departments;
- systematically assess and develop/train staff with regard to SD competencies and awareness;
- foster staff interests, allowing them to become 'champions' of the cause;
- involve staff at all levels, including the shopfloor, in planning and implementation;
- improve internal communications across functions to improve effectiveness and take advantage of synergies;
- take a longer-term view with regard to investment, looking at the indirect/less obvious commercial benefits and the wider non-quantifiable benefits;
- put in place appropriate systems (not necessarily accredited) and provide tools;
- experiment (e.g. pilot projects) and take considered risks;
- network and actively search for information;
- obtain and use new tools (IT or otherwise);
- accept advice and assistance from outside, but only where it is high quality and appropriate;
- involve other stakeholders, including customers/suppliers, the local community, banks, insurers, etc.

As a closing remark we would note that, while we have to take care in developing the wide range of measures needed, there is little time to prevaricate. Progress must be accelerated, particularly in SMEs. We may not be able to find the perfect policy instruments, tools and support programmes. We may not be able to justify them 100%, for example through a lack of knowledge of their impact. These are not reasons for inaction. We have to take a pragmatic approach, one that quickly provides clear and significant incentives across all areas of concern, backed up by comprehensive, appropriate and transparent education, training and support.

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Annex 1

Detailed case study: An approach to company improvements in Denmark

Involvement of workers in environmental initiatives by most parties is agreed to be a positive or even necessary element in establishing an integrative approach to sustainable development in companies. Whether safety and health or other social issues are directly included in the initiatives or not, workers' participation will automatically lead to the focusing on these questions together with the environmental ones.

In the case of Rahbek Fish and the *KRAM* method of Aalborg University, the emphasis in the process of involving the workers was on training and a special educational method was developed.

The method was developed during a project at two fish processing plants each of about 200 employees, together forming the company, Rahbek Fish, in two cities in Jutland, Denmark in 1993. The case is chosen as it illustrates barriers and success factors connected with such initiatives in SME's. Eventually, however, the project resulted in a method that has been applied successfully in other SME's and has been modelled in a national vocational training programme.

In the beginning of the 1990s, the fish processing industry in Denmark faced great problems such as:

- increasing demands for improved and stable quality of products;
- a need to implement cleaner technologies to be able to meet new environmental requirements in a cost effective way;
- demands from the safety and health authorities as well as the social partners to overcome the health problems connected with repetitive work in the industry.

Confronted with these challenges Rahbek Fish chose to engage in a training project proposed by Aalborg University which recognised the potentials of a labour force with many years of experience in the industry. Workshop experiments by the university involving employees from the fish processing industry in other parts of the country had illustrated that the workforce had a comprehensive knowledge of the quality of the raw materials and what happens to the quality during processing. The employees also possessed important knowledge of the negative work environment factors in production and an interest in possible technological changes in order to produce in a healthier and environmentally sound way. Most of all, the employees were very interested in using the "hidden knowledge" in a constructive way and to gain more knowledge. Due to the traditional manner of organising the work and hierarchical structures, these resources had been wasted.

The training project at Rahbek Fish aimed to activate these resources of the employees through a project based on "systematic structuring of existing knowledge and experiences as a starting point for retrieval of new knowledge" (Handberg).

A new educational method was applied based on a reflexive learning process, 'experience-learning'. By focusing on the present experience of the employees the sum of knowledge and experiences they have acquired from previous work, usually not demanded for in their daily working life, can be activated. New knowledge and insights, including changed attitudes, can be achieved when added to existing experiences based on situations from daily work familiar to the employees. In this way existing barriers to learning and developing new insights that often exist when employees have only the most basic school education are coped with.

The method was also reflected in the way the training project was organised:

- All employees (except the management layer) took part in the training. In teams of 12 they went through the training modules sequentially.
- Part one of the course (two weeks at the vocational training centre) aimed at raising quality awareness in relation to work and production methods as well as products. During this part of the course the employees were trained in the project type of work – using computerised audit schemes in relation to a selected part-process in the company, with a view to setting aims for improved product quality, working environment, environment and output.
- Part two (four weeks at the production site) consisted of a realistic mapping of the actual conditions at the selected part process. During normal working hours some time was reserved for working in groups and filling out audit schemes on computers.
- Part three (two weeks at the training centre) consisted of assessing the collected documentation and setting up action plans to reach the elaborated targets. Finally the action plan proposals were discussed with representatives from management.

Throughout the training period the teams continued as 'development rings' with a 'champion' to implement the action plans in co-operation with management.

Reports from Aalborg University have shown considerable benefits resulting from the training process. Through the problem-oriented work, the educational method and the tools and

possibilities of qualification provided to the employees their individual and collective knowledge was transformed into competent action plans for technological changes in production. A most significant factor for the success was perhaps the boasting in public by management of the achieved results: water savings in one year by 40%, energy savings by 30%,, etc. (see *Dagbladet*, a local newspaper, 20/12/94).

The success of the project at Rahbek fish and the KRAM method of Aalborg University is also manifested through the fact that a series of other projects in companies, some of them supported by the Environmental Protection Agency of Denmark, have used the same model and educational method. Furthermore, the public vocational training system of Denmark, offering state-supported courses for employees in any company, has set up a modular training programme, modelled after the KRAM-project. These courses are increasingly being used by the environmentally progressive companies in the country.

Internal barriers

- Parts of the workforce profiting from existing work organisation, including some trade union representatives, obstructed the project and the option of changes in work organisation;
- Rivalry between old leaders in the workforce and the new-coming 'champions' of the project;
- Insufficient traditions of co-operation and commitment to the project by management as it showed up that the employees had serious expectations to the carrying through of the proposals in the elaborated action plans which management rejected or hesitated to carry on;
- Insufficient preparations from management regarding the quite thorough changes in work organisation and production processes necessary to cope with hazardous repetitive work functions;

Important internal success factors

- Management's capability to cope with problems in an integrated way, base solutions on internal resources and see the capacity-building possibilities of the workforce;
- A general open-mindedness to learning and changes in work organisation among the employees in combination with the presence of committed staff including some of the trade union representatives.

Important external success factors

- The existence of explicit, powerful requirements to the improvement of environmental and working environmental performance;
- Economic barriers to the continuation of traditional resource use and emission control technology;
- Incentives, including financial, to train employees;
- Extensive efforts and resources from different local authorities and labour market institutions in the setting up and carrying through of the training programme;
- Relevant expertise to assist in identifying targets and means in the transformation process of the company, developing the training programme and implementing the new educational methods.

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Annex 2 Abbreviations

ADEME	Agences Départementales pour l'Environnement et la Maîtrise de l'Energie
ADL	Arthur D. Little
BCC	British Chamber of Commerce
BEC	Business and Environmental Co-ordinators
BMD	Bedrijfsmilieudienst (Industry Environmental Agencies, The Netherlands)
BSI	British Standards Institute
BST	Bedriftssundhedstjeneste (Occupational Health Service, Denmark)
CEST	Centre for the Exploitation of Science and Technology
CFSD	Centre For Sustainable Design
CIWEM	Chartered Institute for Water & Environmental Management
CPP1	Cleaner Production Programme 1
CSR	Corporate Social Responsibility
DETR	Department of Environment, Transport and the Regions (UK)
DfEE	Department for Education and Employment (UK)
DJSGI	Dow Jones Sustainability Group Index
DGB	Deutsche Gewerkschaftsbund (German Trade Unions Federation)
DRIRE	Directions Régionales de l'Industrie, de la Recherche et de l'Environnement (Regional Industry, Research and Environmental Authority, France)

DSD	Deutsche Systems Duales
DTI	Department of Trade and Industry (UK)
EARA	Environmental Auditors Registration Association
EET	Economy, Ecology, Technology
EFILWC	European Foundation for the Improvement of Living and Working Conditions
EIA	Environmental Impact Assessment
EIRO	Employment and Industrial Relations Observatory
ELV	End of Life Vehicles
ENDS	Environmental Data Services
EMAS	Environmental Management and Audit Scheme
EMS	Environmental Management System
EPA	Environmental Protection Agency
EPE	Environmental Performance Evaluation
ESF	European Social Fund
ETBPP	Environmental Technology Best Practice Programme (UK)
FITA	Federazione Italiana Industrie e Servizi Professionali e del Terziario Avanzato (Federation of Professional Industry & Service Organisations)
GM	Genetically Modified
GRI	Global Reporting Initiative
HSE	Health and Safety Executive (UK)
HSEQ	Health, Safety, Environment and Quality
ICT	Information and Communication Technology
ILO	International Labour Organisation
IPP	Integrated Product Policy
IPPC	Integrated Pollution Prevention & Control
ISCED	International Standard Classification of Education
ISO	International Standards Organisation
IT	Information Technology
JRC	Joint Research Centre
LCA	Life Cycle Analysis
LDC	Less Developed Countries
LTA	Long Term Agreements (Dutch term for Voluntary Agreements)

NFFO	Non-Fossil Fuel Obligation
NGO	Non-Governmental Organisation
OECD	Organisation for Economic Co-operation and Development
OMB	Owner Managed Business
OHS	Occupational Health and Safety
OSHMS	Occupational Safety & Health Management System
PRN	Packaging Recovery Notes
R&D	Research and Development
SCORE	Service Corps of Retired Executives
SCI	Supply Chain Initiative
SCP	Supply Chain Partnership
SD	Sustainable Development
SHE	Safety, Health and Environment
SHEMS	Safety, Health and Environment Management Systems
SIGMA	Sustainability Integrated Guidance for Management
SME	Small and Medium Sized Enterprise
SP	Sustainable Production
TNA	Training Needs Analysis
TQM	Total Quality Management
UN	United Nations
UWE	Walloon Employers Federation
VA	Voluntary Agreements
VEMS	Volvo Environmental Management System
VOC	Volatile Organic Compounds
VROM	Ministry of Housing, Environment and Spatial Planning
WEC	Wales Environmental Centre
WEEE	Waste Electrical & Electronic Equipment

Annex 3 Glossary of key terms

ADAPT	An EU Community Initiative, funded by the ESF, aimed at helping the workforce respond to industrial change, and to promote growth, employment and the competitiveness of companies. Some 4,000 projects were funded between 1995 and 1999 – many of these involved SMEs and some had an environmental theme.
Biorefining	Biorefining is the systematic use of innovative technologies to produce a range of new products from agricultural crops (food and non-food), using everything from the stalks and stems to the husks and grains, utilising what would otherwise have been waste.
Cleaner technology	Process equipment that inherently leads to reduced resource use and emissions which are less harmful to people and the environment, including end-of-pipe equipment where this allows the reuse of a resource such as effluent or hot gases.
Distance learning	Learning that takes place via postal correspondence or electronic media, linking instructors and students who are not together in a classroom
Eco-design	The approach to the creation (through design and specification) of products that are inherently more resource-efficient and less damaging to people and the environment, through their life-cycle as a whole, than 'normal' (typical) products.

Eco-efficiency	More resource-efficient and less damaging means of operating, in relation to 'normal' (typical) manufacturing and business practices. As used here the term relates to processes rather than products and encompasses process optimisation (waste minimisation/energy efficiency), reduced use of toxic materials and the adoption of 'cleaner technology'.
EMAS	An environmental management system with an overall objective of promoting continuous environmental performance improvements in industrial activities by committing sites to evaluate and improve their environmental performance and provide relevant information to the public. The scheme has been open for participation by companies since April 1995.
Environmental Management System	A management tool enabling an organisation to control the impact of its activities, products or services on the environment. It makes possible a structured approach to setting environmental objectives and targets, to achieving these and to demonstrating that they have been achieved.
European Social Fund (ESF)	The EU's main tool for the development of human resources and the improvement of the workings of the labour market. It supports measures to prevent and combat unemployment and to develop human resources. The ESF aims to promote a high level of employment, equality between men and women, sustainable development and economic and social cohesion.
Free-riding	Taking advantage of a particular agreement or service whilst not meeting your own obligations (financial or otherwise) for its upkeep.
Green procurement	The purchasing of goods and services that are more resource-efficient and less damaging to people and the environment, through their life-cycle as a whole, than 'normal' (typical) goods and services.
Industrial districts	Spatially concentrated groups of enterprises and related institutions (e.g. trade associations) engaged in single or interrelated industries. A high level of interaction and trust occurs between actors. Popularised by the Italian region of Emilia Romagna but other regions in Europe also display characteristics of the Industrial District.
Industrial ecology and eco-industrial parks	Industrial ecology, or 'by-product' synergy as it is sometimes known, involves 'waste exchange' whereby the residue from one industrial process is the feedstock for another, preferably local, process. In this way industries exist in more symbiotic relationships, in some cases co-located on eco-industrial parks (EIP).

Initiative fatigue	The characteristic, faced by many enterprises (especially SMEs) of having been so overwhelmed with previous initiatives (in whatever sphere) that they find it difficult to motivate themselves to participate in future ones. This is especially common when past initiatives have failed to deliver the promised advantages or when the enterprise has limited administrative/managerial resources.
ISO 14001	An environmental management system (EMS) standard, introduced in October 1996, and with world-wide popularity. Meeting its requirements demands objective evidence which can be audited to demonstrate that the EMS is operating effectively in conformance with the standard.
LIFE	An EU financial instrument in the environmental sphere, dating back to 1992, co-funding is available for three major areas of action: the environment and nature protection in EU Member States and environmental projects in selected non-EU states (mainly in the Mediterranean).
Objective regions	Those regions of the EU which receive the largest amount of Structural Funds support because of their low income levels (per capita GDP less than 75% of the EU average) or particularly disadvantageous geographical situation (extremely remote or thinly populated). Some 83.25 million inhabitants of the EU (or just over 22% of the total population the EU) live in Objective 1.
Permaculture	Permaculture is the application of small-scale intensive systems which are labour efficient and which use biological resources, stress ecological connections and use closed energy and material loops.
Professional education and training (PET)	Training which is in some way linked to employment. It can mean training for people who are already employed or else training aimed at allowing people (e.g. the unemployed) to enter employment. Similarly, it can refer to training which is specific to a particular profession (e.g. hygiene awareness in the food and drink industry) or else training which is more generic and aimed at increasing those skills which are relevant to a whole range of different professions (e.g. basic information technology). PET has the same meaning as vocational training and the two terms are often used interchangeably.
Shop steward	A union member elected as the union representative within a particular enterprise in dealings with the management

Social partners	Trade unions (representing the workers) and trade/ employers associations (representing companies). In several Member States of the EU where employment policy is very consensus-based, these have an important role in formulating policies and agreements which affect working conditions.
Small and medium sized enterprise (SME)	The EU definition is a company with less than 250 employees, a yearly turnover of less than 40 million euro or a balance of less than 27 million euro and less than 25% of its capital or voting rights in the ownership of a non-SME.
Structural funds	EU funds aimed at contributing to the achievement of economic and social cohesion in the European Union. Resources are targeted at actions which help bridge the gaps between the more and the less developed regions and which promote equal employment opportunities between different social groups. There are four Structural Funds: The European Regional Development Fund The European Social Fund The European Agricultural Guidance and Guarantee Fund The Financial Instrument for Fisheries Guidance
Sustainable development	Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.[13] Sustainable development therefore comprises environmental, social and economic dimensions.
Sustainable production	Sustainable production (SP) is the provision of goods and services within the carrying capacity of the environment. In the environmental sense it encompasses eco-efficiency and eco-design but goes beyond this in terms of 'dematerialisation' (e.g. providing services instead of goods) and by primarily using renewable materials (e.g. natural fibres rather than plastics), recycled/waste materials (e.g. through waste exchange), renewable energy (e.g. wind power) and soft/green chemistry (e.g. without the use of toxic chemicals, high pressures and temperatures). It naturally relates to such concepts as biorefining, permaculture and 'industrial ecology'. In the socio-economic sense it encompasses SWE but also maintains or improves the 'quality of life' of its employees and those in the local community, through providing for other human needs such as job satisfaction, job security, equity, inclusion, leisure time, etc.

[13] *Our Common Future* (1987) by the World Commission on Environment and Development (WCED), Oxford University Press, page. 43.

Sustainable working environments	Sustainable working Environments (SWE) are those which provide healthy, safe and pleasant working conditions for employees. Ideally this is done in the context of the overall environment (internal and external) and ideally as part of an integrated approach to Health, Safety and Environment. It can be argued that a sustainable working environment is also one that involves staff consultation and participation at all levels.
Training needs analysis	The systematic analysis of skills required in a company's business plan, or set by the business strategy, against the available skills in the workforce. A training needs analysis highlights the gaps (in skills) where training should occur to meet the business objectives.
Vocational training	Training that is specifically related to a particular profession or part of a profession.
Voluntary agreement	An agreement between a public institution (e.g. national or local government) and business (association or individual company) to achieve a certain environmental target or implement certain agreed measures.
Waste minimisation	The reduction of resource wastage (materials, water, energy, etc.) at source, i.e. within the process or at least on the premises where it has occurred.
Works Council	Groups of workers in an enterprise with responsibility for negotiating with the management on areas affecting working conditions. In many Member States they are a requirement in firms above a certain size and have a legally defined status.

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Design for sustainable development

Success factors

Following the Treaty of Amsterdam, the move towards sustainable development is enshrined as one of the main aims of the European Union at a general policy level. Business, in particular, is having to meet the requirements of Community environmental and sustainable development policy and has in many cases had to adopt new approaches to management, to material and resource use, to product design as well as to customer/supply chain relations.

This report analyses what constitutes successful sustainable design, taking design in the broadest sense to encompass the entire industrial process. The aim is to identify what are the barriers to sustainable design approaches – especially at small and medium-sized enterprise (SME) level – and what processes and initiatives can help companies overcome these barriers. The report also serves as a summary of the main findings of the Foundation's wide-ranging work on this topic over four years.

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