

About: Sustainability

By Beatrice K Otto

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In brief

Also known as design for sustainability (DfS), design for environment (DfE), eco-design and green design.

Sustainable design is everything good design ought to be, delivering the best (social, environmental and economic) performance or result for the least (social, environmental and economic) cost. It is the strategic use of design to meet and integrate current and future human needs without compromising the environment. It includes (re)design of products, processes, services or systems to tackle imbalances or trade-offs between the demands of society, the environment and the economy and requires the holistic consideration of the impact of products or services in these three areas, now and in the future. Where possible, it also includes restoration of damage already done.

The crux of sustainability is these three so-called pillars:

1. Social – people
2. Environmental – planet
3. Economic - profit.

However, the word 'pillar' suggests separate, static entities when in fact there is a dynamic between all three elements. It might be easier to think of them as three balls in a juggling act - the trick is to keep them working together in a simple, smooth process. At the moment, it has to be said, we often don't tend to juggle too well. But we're making progress.

The term sustainable design (also known as design for sustainability, or DfS) is often used interchangeably with related terms such as eco-design or design for environment (DfE), or even green design (less used these days). This overlap stems from the fact that sustainable design evolved from the attempt to incorporate environmental considerations into design and the environmental aspect is arguably still the key one being examined and addressed.

This involves assessing where a product (of whatever kind) has the greatest environmental impact and then prioritising ways to reduce that. For example, some household appliances have the greatest impact in use, not in manufacture or disposal, in which case energy efficiency might be the top priority. Issues to consider include:

1. Materials - using less materials (lightweighting), fewer (making it easier to recycle) and if possible avoiding toxic substances and choosing renewable or recycled/recyclable.
2. Dematerialisation - could include some of the above, lightweighting for example, but also designing things to be multifunctional, or finding a different way to deliver the same benefit through a service or product-service combination (so-called product service systems).
3. Design for disassembly - making things easy to take apart so they can be repaired, serviced, upgraded, remanufactured, or recycled, such as through modular design, or smart materials which can self-dissemble when needed.
4. Energy - both in production (which would mean looking at the manufacturing process), and in use and disposal. This includes minimising energy use, moving to the use of renewable energy, and extracting energy from waste in some cases.

5. Life extension - keeping a product, or its parts or materials, in productive use for their optimal lifespan, so slowing or preventing the linear flow of materials from extraction and processing to disposal.
6. Transport - minimising it, that is. Sourcing a renewable, impeccably green material which you ship four times round the world may not be as sustainable as something a little less clean from down the road.

Another juggling act in other words - it might not be possible to do all of the above at once - hence the need to look at the greatest impact or, alternatively, the area that is most realistic, first.

Nevertheless, a 'green product' could actually be unsustainable. Let's imagine you make something that uses recyclable and renewable materials, but you use child labour so nobody wants to buy it, and it ends up being dumped anyway, driving you out of business. You would have thrown the environmental ball up in the air for a moment, but you'd have dropped the social and economic balls, with the environmental one following soon after.

Because sustainability is by its nature multidisciplinary, it tends to straddle various organisational functions and considerations, which can make it tricky to know where to assign it. Some simply create a sustainability function or department. Others put it under environmental management or with corporate social responsibility (CSR). Both make sense. Corporate social responsibility, if taken to mean a company's responsibility to the society in which it operates, would reasonably include not ruining the environment. And sustainability includes social issues as much as environmental - how you treat your employees and customers, and what you give back to the community (ideally more than just a guilt-assuaging charity cheque once a year).

Design is utterly crucial to moving towards a more sustainable future - by rethinking how we deliver products and their benefits without exhausting or decimating the world around us, or compromising the well-being of others (now or in the future); and by using sustainability as a key to enhanced performance and greater competitiveness.

Sustainable design needs a broad, open, flexible and long-term mindset. It means bearing in mind the impact of a product including origins and disposal - so-called life-cycle thinking. It also means examining whether there is a different way to deliver the same function through a service or a product-service combination. That in turn can mean a new way of doing business and new customer relationships. Service design is currently much discussed as a potential source of sustainable solutions.

Why it matters to business

Some of the most innovative sustainable design work is going on within companies. Firms such as Interface or Herman Miller are designing sustainability into every nook and cranny of their strategy and operations. Others, such as Philips, employ some of the key movers in the field.

Since sustainable design is about minimising negative impacts while optimising performance and wellbeing, it can have a lot to do with competitiveness, hence the term 'the triple bottom line' referring to the three key pillars of sustainability. Sometimes a more catchy term is used - 'people, planet, profit'. Satisfying the demands of this trinity is a bit of a balancing act, but at its best sustainable design should help companies design things which have less impact on the environment, reducing energy and material use, waste and related costs. It can also create a better working environment and corporate culture, by engaging employees and raising productivity.

For instance, Herman Miller redesigned the way it packaged chair bases and saved labour time and costs, as well as reducing the amount of waste it had to send to landfill (and pay for) and the materials it had to buy in for new packaging. In other words, the company aimed to hit all

bases - social (better employee conditions), environmental (reduced raw materials coming in and waste going to landfill) and economic (lower financial costs).

There is growing evidence that sustainable design can improve employee morale and productivity by providing a better work environment on the one hand, and engaging the creativity of employees on the other. Dupont and others have made large savings based on employee suggestions.

Ideally too, it can trigger or enhance innovations that deliver better performance to customers. Sustainable design can begin with more easily achieved targets, such as waste minimisation; but it implies finding new ways to deliver customer satisfaction, either through a better-designed product (more efficient, longer lasting, easier to use or more appealing and so worth keeping), and/or through different business models (services, leasing, renting).

There are hundreds of examples of organisations saving money by taking the first steps towards sustainable design, and there is still plenty of untapped potential. This could be through retrofitting buildings or redesigning production processes, for example. Ultimately, however, **sustainable design is about designing problems out of the system in the first place**, rather than solving them after they've been created. To do this means thinking about the context - social, environmental and economic - of the product, and considering the whole system in which you operate.

Examples

1.

Project: Aeron chair
Client: Herman Miller, US
Designer: Don Chadwick and Bill Stumpf

Ergonomics in motion, this iconic chair has the 'teddy bear factor' through and through due to its comfort - people want to drag it with them from office to office. It's easily assembled and disassembled, allowing for maintenance in situ (avoiding transport back to the workshop), and for recycling at the end of life. Designed to be more durable than most office chairs, it also replaces the standard foam-and-textile back with a breathable membrane. Not only does this keep the sitter's body at ambient temperature, it can also reduce air-conditioning costs.

Sustainable design elements: design for durability, design for disassembly, easy to repair, refurbish and recycle, teddy bear factor, reduces air-conditioning costs while increasing comfort.

2.

Project: Ariel 'Magicare'
Client: Procter & Gamble, US

As part of Procter & Gamble's definition of sustainable design as enhancing quality of life, it developed the Magicare or 'one dollar washing machine'. Market research told the company that vast numbers of women still do washing by hand in developing countries. The small, handheld, ergonomically designed, lightweight and durable Magicare allows them to use a detergent in solution and achieve the same cleaning effect of scrubbing on a washboard, while protecting their hands from contact with rough surfaces or detergents, and giving improved performance and convenience. The device has been introduced in Mexico, Morocco, Pakistan and the Philippines.

Sustainable design elements: deals with the social and development side of sustainable development, bringing an interim solution to people who don't have access to washing machines. It also has a low material impact compared to the washing machine - a few ounces of plastic compared to chunks of metal and wiring, and human-powered. Also reduces the need for additives to deal with tough stains.

3.
Project: Chemical Strategies Partnership
Client: Tellus Institute, US

The Tellus Institute has been setting up partnerships between manufacturers and their chemicals suppliers. Instead of selling chemicals by volume, the new business model - Chemical Management Services - sells optimal management of chemicals. The client thereby benefits from the chemical supplier's expertise and is free to get on with running their own business. Chemicals are therefore used more efficiently, saving the customer money and improving their environmental performance. General Motors has seen costs and chemicals use reduced by over 30% at plants which have used the model. A semiconductor plant which used the model reduced chemical consumption by 50% and hazardous waste by 8% over two years.

Sustainable design elements: shift from goods to services; low level material impact - obtaining more utility for less 'stuff'.

4.
Project: Gridcore
Client: Gridcore Inc, US

A replacement for particle board, made of waste paper using closed-loop production processes. The board is lightweight (reducing transport needs) but very strong due to its honeycomb design which gives it physical resilience without the need for mass. It is also versatile in use and can take a variety of finishes, making it suitable for exhibition stands, point of purchase displays, stage props and film sets, and even emergency shelter.

Sustainable design elements: closed-loop clean manufacturing; using recycled materials which can themselves be recycled; biomimicry - learning from nature (mimicking the bee's honeycomb in this case) to create a structure which is both lightweight and robust.

5.
Project: Disposable camera
Client: Kodak, US

'Disposable' is often a dirty word in sustainable design, suggesting a careless 'throwaway' attitude to valuable resources. Kodak's camera has been designed to snap apart, allowing nearly 90% of the parts to be recycled or remanufactured into new cameras. Because of the high rate of turnover, the cameras maximise 'utility', that is, they are in use much more than most of the non-disposable cameras we have sitting at home. Maximising utility - the amount a product is actually in use - is a key strategy for reducing environmental impact, hence the benefits of car-sharing, fewer cars being needed to serve a given number of people.

Sustainable design elements: design for recycling and remanufacture; cradle-to-cradle closed loop, with 'disposed of' cameras being turned into new cameras; lightweight; maximising product utility.

Facts and Quotes

Facts

1. The 80:20 Rule applies to sustainability (or rather the currently unsustainable way we live): it is generally agreed that the developed world takes about 80% of the resources being used, to provide for the consumption of about 20% of the world's population.
2. In the US it's more like a 25:5 Rule, with about 4.7% of the world's population using nearly a quarter of its energy.

3. The Intergovernmental Panel on Climate Change considers that to stabilise atmospheric carbon dioxide, emissions in the industrialised world will need to be reduced to 60% of their 1990 levels by 2050. The Panel estimates an increase in temperatures of 1.4-5.8°C, with the lower end of the scale more likely. The range of increase probably needs to be kept within 2-3°C.
4. It is estimated that the UK per capita ecological footprint - the amount of productive land needed to provide for current consumption - is about 3.5 times the biologically productive land area in this country. The average 'fair earth share' is about two hectares per person, the average actual footprint is 2.85 and the OECD average is 7.2. The US tops the list with about 13.26 hectares per person. Footprint figures do vary according to the source, but the proportions are consistent.
5. Experts are reaching a consensus that to become sustainable will mean at least a Factor 4 increase in resource efficiency, though many suggest Factor 10 or more. This will mean an even greater factor of efficiency in the developed world (Factor 10 to 20, that is, a reduction in resource use of 90% or more) since it is responsible for the lion's share of unsustainable resource use, and so will have to make a greater leap to allow quality of life to improve in developing countries.
6. 20% in the red - the US National Academy of Sciences has confirmed what most people knew already - that humanity has been living beyond its means for a few decades. Resource consumption is now at about 120% of its replenishment rate. As recently as the 1960s we were 'in the black' at 70%. We're now the wrong side of the so-called point zero of sustainability.
7. In the UK, homes are responsible for nearly a third of the energy delivered and a quarter of carbon emissions.
8. Schmidt-Bleek, a key mover and shaker in the Factor 10 Club, estimates that on average, industrial products carry non-renewable rucksacks - resources used in their production which the user never sees - of about 30 times their own weight.

Quotes

'At the heart of sustainable development is the simple idea of ensuring a better quality of life for everyone, now and for generations to come.' UK Government definition, 1999, Department for Environment, Food and Rural Affairs.

'Our biggest challenge in the new century is to take the idea that seems abstract - sustainable development - and turn it into a daily reality for all the world's people.' Kofi Annan, UN Secretary General, March 2001.

'Competitiveness is a pillar of sustainable production... competitiveness and environmental performance have traditionally been viewed in terms of trade-offs... However, this logic really applies to remedial responses to production systems that were not designed with environmental impacts or limits in mind.' EU Expert Group on Sustainable Production, report, 2001.

'Global warming is here to stay as a hot button for policymakers, a wild card for business, and a disturbing prospect for us all.' *Fortune*, 8 December 1997.

'We are now in a transitional phase of industrial history in which companies are still inexperienced in handling environmental issues creatively... The early movers - the companies that can see the opportunity first and embrace innovation-based solutions - will reap major competitive benefits.' **Michael Porter and van der Linde, 'Green and competitive', *Harvard Business Review*, 1995.**

'So what have we learned? Within the company, we're learning the extraordinary motivating power of a constructive environmental stance. We're learning that there is no trade-off

between profits and pollution.' Sir John Browne, CEO of BP, quoted in *Cool Companies*, Joseph J Romm, Earthscan 1999.

'The conventional wisdom is mistaken in seeing priorities in economic, environmental, and social policy as competing. The best solutions are based not on trade-offs or "balance" between these objectives but on design integration achieving all of them together.' Hawken, Lovins and Lovins, Rocky Mountain Institute, *Natural Capitalism*, Earthscan 1999.

'Design for sustainability means fostering innovation - not just in products and services but in work methods, behaviours and business processes.' John Thackara, *Eternally Yours*, 1998.

'Sustainable growth has to be focused on a functionality not a product... the next major step towards sustainable growth is to improve the value of our products and services per unit of natural resources employed.' DuPont, J A Krol, Remarks at the CIED World Forum on Energy and Environment, Caracas, 18 November 1997.

'To me, proving that earth's climate is changing from human actions... is like statistically "proving" the pavement exists after you have jumped out of a 30-storey building. After each floor your analysis would say "so far - so good" and then, at the pavement, all uncertainty is removed.' Richard Jones, Vice President Engineering, Hartford Steam Boiler Insurance and Inspection Company, quoted in Lawrence Berkeley National Laboratory, *US Insurance Industry Perspectives on Global Climate Change*, 2001.

'It is often said that sustainability rests on three equal pillars: environmental, economic and social. However, designers often ignore the social and cultural aspects. Ecodesign, especially when practiced by engineering designers, is taken as a technical problem.' Professor Matthew Simon and Andrew Dixon, Sheffield Hallam University, *Opportunities for Sustainability Messages in Product Services Systems*.

Challenges

The experts, as they would readily admit, don't have all the answers. A great deal of progress has been made in the last five or ten years, but this is a relatively new field and there's plenty of experimentation going on. There's a good idea of what needs to be done - environmentally speaking, for example, developed nations need to improve their resource efficiency by a factor of ten or even 20 to be sustainable while making room for developing countries to also enjoy an improving quality of life.

There's a lot of discussion about how to get there, as one size won't fit all. Sustainable design therefore benefits from a range of approaches and techniques, and flexibility in what to apply where. Some of the key challenges being grappled with in the field are:

Making the business case

Despite a burgeoning of case studies and good examples of the benefits of sustainable design for business, more clear-cut evidence for its link to competitiveness is still needed. Among others, organisations such as SustainAbility (a consultancy) and the World Business Council for Sustainable Development (WBCSD - a think tank formed by a number of leading multinationals) are working at this and experts are always on the look-out for examples that are both inspiring and convincing.

Working out the metrics

Partly linked to making the business case is the need to find ways to measure sustainability. More economics-based measures such as GDP are proving inadequate to the task and there is a great deal of research into how sustainability can be measured or recorded at both a regional/national level, and within organisations. Some standards are emerging, and these will be refined over time.

Addressing the demand side

Most of the work on sustainable design has focused on the supply side - helping companies rethink the way they operate. However, unless consumption patterns change, we will only get so far, hence the need to address the demand side. There is some innovative work going on to engage consumers in the creation of a more sustainable future. Part of this entails considering them as 'people' rather than just 'consumers' or 'users' - sustainability does actually mean addressing quality of life for people as whole human entities, rather than responding to a few facets of their being.

Getting the message out there

The term 'sustainability' has both a communication problem and an image problem. It doesn't resonate with most people on first encounter - a grasp of what it means tends to grow with exposure. The trend to describe it in terms of 'quality of life' will help communicate its relevance to a wider audience.

This can also help combat the image problem - that sustainability is about suffering, turning back the clock, 'doing without'. Unless it becomes relevant and appealing to society at large, it will get nowhere. Some of the most innovative people in the field are considering how to make sustainability graspable and relevant to mainstream society.

A similar challenge is how to permeate the organisation with an understanding of what sustainability is and how it can benefit employees and customers as well as the wider body of 'stakeholders'. A few initial demonstration projects can help, but at some point organisations need to move beyond discrete projects and figure out how to integrate sustainability across the board - and that needs real support at a senior level - a couple of workshops might get the ball rolling but they won't build it into the system.

How to...

There are a number of tools available to help with sustainable design, from checklists to software programmes. These can help with setting design priorities and providing life cycle data on materials, for example. However, the awareness (let alone take-up) of such tools by designers, engineers and companies, is astonishingly low.

Lack of knowledge is part of the problem, but many tools also fail to take account of different styles of working. For example, life cycle analysis tools are often considered too quantitative and dry to appeal to designers. Some work is emerging to try to bridge the language barrier between different disciplines.

Finding the right tools and information can be difficult. Not because there isn't piles of information available, but it isn't widely known or accessible to people outside the field. There are excellent guides and software packages to inform decisions, but not always the expertise to even know where to start looking for these.

Straddling disciplines

Sustainability sits across various functions and disciplines, whether it's being considered in a private or public sector organisation, or being researched in an academic context. The challenge is preventing the strictures of disciplinary or functional divisions getting in the way of this most multidisciplinary of subjects.

There is a growing awareness of this aspect, and various centres of excellence are themselves interdisciplinary. In addition, the use of networks of individuals and organisations is being recognised as a way to circumvent this problem - at a UK and EU level for example, funding is being made available for the formation of networks.

Developing markets

Some sustainable resources - renewable materials or energy, for example - have not yet reached the critical mass to compete with conventional, less sustainable resources. Legislation and the greening of public procurement can help create markets, and initiatives such as the UK Government's WRAP (Waste and Resources Action Programme) programme - which

focuses on creating stable and efficient markets for recycled materials and products - are intended to encourage this.

Hindrances include 'perverse' subsidies for non sustainable resources or ways of doing things - and the removal of these to create a level playing field needs political will. There is also the problem of lack of awareness - linking to the 'how to' challenge above - even companies or designers who want to use sustainable materials often have difficulty finding out what exists and how it rates. There are a number of initiatives seeking to address this knowledge gap.

Future trends

Reactive to proactive

It is likely that more companies will start to view sustainable design as a strategic issue and that it will be further integrated into existing design processes. This may be partly fuelled by growing legislation, but it is also likely to become something of a competitive issue.

Greater understanding

Sustainability is a word that doesn't mean much to a lot of people, and to many people is a synonym for 'environment'. Over time, it's likely that its three-legged nature (social, economic and environmental) will become more widely understood, and a consensus of definitions will emerge. Currently sustainability is sometimes added to the corporate social responsibility function of companies, and sometimes added to the environment function, for example. Encouragingly, there is a trend to define sustainability in terms of improved quality of life for all, now and in generations to come, which is likely to make it feel more real and graspable to many people.

Risk management and insurance

Some of the impetus for sustainable design is likely to come increasingly from the insurance industry, as it reviews liability for environmental damage and security risks. September 11th may have given a boost to this trend.

Consumer pressure

Consumer pressure can be a fickle thing, but it can also have a big impact. Generally consumers won't pay more for 'greenery'. However, shocks such as BSE can bring huge pressure to bear on business. Witness the consumer furore over genetically modified (GM) crops ('Frankenstein foods') in the EU, causing some supermarket chains to quickly change their stance on GM products. There is a growing body of research regarding consumer behaviour and how it can help or hinder the move towards sustainability.

Legislation

There is a trend to increasing legislation, with the EU currently leading in overall stringency, though Japan may take over, and some American states in some respects (such as California for car emissions) are noteworthy. It is likely that this will continue, and recent directives will start to bite - such as the Directive on Waste from the Electrical and Electronics Sector (WEEE Directive), and the End of Life Vehicle Directive which is already forcing car manufacturers operating in Europe to think about recycling cars.