Sustainable Consumption and Production: Quality, Luxury and Supply Chain Equity

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Abstract Sustainable development is presented as a response to the recognition of long-term limits on the human economy, expressed as three sets of constraints: techno-economic efficiency, environmental compatibility and social equity. Assessing and improving the sustainability of products and services necessarily requires a life-cycle approach, considering the complete supply chain, and examining the role of consumption as the driver for production. The economic and environmental dimensions can be explored by integrating value chain analysis (VCA) and life-cycle assessment (LCA) to show the distribution of economic benefits and environmental impacts along the supply chain. Environmental intensities (i.e. impact per unit of added value) are frequently high for material extraction and refining, and reduce progressively along the supply chain through manufacturing and distribution. Amongst other conclusions, this finding reveals inequity and unsustainability in many supply chains. Incorporating consideration of social equity in analysis of supply chains will require further methodological development, not only to record the social benefits of activities in the supply chain but also to analyse the relationship between the agents in the supply chain. This will require "soft system" analysis to complement the "hard system" approaches of VCA and LCA. From the consumption perspective, sustainable development requires not only reduction in the environmental intensity of products and services

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but also more equitable distribution of economic and social benefits along the supply chain. For consumers in affluent societies, income is the main determinant of consumption. A popular and acceptable message for such consumers could be that sustainable consumption is consistent with purchasing expensive items with low environmental impacts and equitable supply chains, rather than cheap and frugal items; i.e. quality and luxury rather than quantity.

Keywords Sustainable consumption · Supply chains · Equity · Decoupling · Ecometrics

1 Introduction

1.1 Sustainability: Living within Constraints

Given the way literature on the subject of "sustainability" and "sustainable development" has blossomed since the words were placed firmly in the international lexicon by the report of the Brundtland commission (WCED 1987), a contribution featuring "sustainability" must declare at the outset how the term is interpreted. When the concept was first articulated, the focus was on the developing world, to insist that economic development must not be pursued at the expense of environmental degradation. Increasing awareness of the interconnectedness of the global economy and realisation that some environmental impacts, notably global climate change and depletion of stratospheric ozone, affect everyone on the planet has since raised sustainable development to a universal imperative.

This particular contribution is written from the perspective of relatively affluent societies and consumers. "Sustainability" is interpreted in the sense summed up by Jackson (2010): "Sustainability is the art of living well, within the ecological limits of a finite planet", with "living well" to be interpreted in a moral sense, not merely equated with material consumption or physical comfort. "Sustainable development" is taken to mean *enhancement of quality of life and well-being.*[1] This interpretation dates back at least to the Brandt Commission: "One must avoid the persistent confusion of growth with development, and we strongly emphasize that the prime objective of development is to lead to self-fulfilment and creative partnership in the use of a nation's productive forces and its full human potential" (Brandt 1980). More recently, it has been reinforced by arguments that, for people living above subsistence levels, well-being and quality of life are not necessarily correlated positively with economic measures such as per capita GDP or

[1] Although the point is not explored here, we suggest that this approach to sustainable consumption is compatible with the views of those, like Ehrenfeld (2008), who interpret "development" in the narrow sense of growth in conventional economic output and therefore conclude that it cannot ever be sustainable.

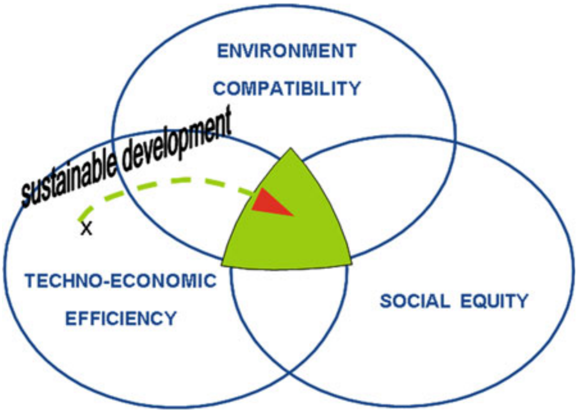

Fig. 1 Sustainability and sustainable development (after Clift 1995)

disposable income (e.g. Layard 2005; Jackson 2006) and that development should be interpreted as increase in freedom (Sen 1999).

The underlying principle is that we are living on a planet which is finite both in the material and energy resources available for human use and in its capacity to adapt to human activities and emissions without catastrophic change to the biosphere. It is helpful to distinguish between three sets of constraints which limit long-term human activities, and to represent them in the form of a simple Venn diagram, shown here as Fig. 1[2]. "Techno-economic efficiency" represents the ranges of activities available to us, limited by our technical skills and ingenuity, by the unassailable physical limitations represented by the laws of thermodynamics and by the need to be efficient as defined by the economic system within which we deploy our skills and ingenuity. "Environmental compatibility" represents the range of activities which can be pursued indefinitely within the resource and carrying capacity of the planet. "Social equity" represents the moral imperative implicit in the original Brundtland statement and subsequently articulated, for example in some of the UK Government's policy statements, as "the simple idea of ensuring a better quality of life for everyone, now and for generations to come" (DETR 1999). It is related to the principle of Environmental Justice; see Blewitt (2008).

Interpreting each of the labels in Fig. 1 as a set of long-term constraints underlines that there are limits on any trade-offs between the three components. For any sustainable futures to exist, the three sets of constraints must overlap. Thus "sustainable" ways of living are represented by the region at the centre of Fig. 1. While the current human economy generally operates within the Techno-economic Efficiency lobe, as indicated by point X in Fig. 1, it clearly does not comply with either of the other sets of constraints. "Sustainable development" is then

[2] This three-component model and its significance for the engineering profession in particular is explored in more detail elsewhere (e.g. Clift 1995, 1998, 2006; Mitchell et al. 2004; Royal Academy of Engineering, 2005). It embodies the "triple bottom line" approach to sustainability accounting.

represented by a trajectory moving from present practice to the "sustainable" region. Given that equity is essentially an ethical concept, ethical concerns about "living well" must guide this trajectory (see e.g. Mitchell et al. 2004).

Attention in the industrialised world has concentrated on environmental technology; i.e. on moving into the overlap between "Techno-economic Efficiency" and "Environmental Compatibility". Sustainability requires a "whole system" approach (Clayton and Radcliffe 1996). One of the essential tools guiding the development and deployment of environmental technologies is therefore life-cycle assessment (LCA), whose role is to reveal and quantify environmental impacts and resource use along the complete supply chain of a product or service. Attributional LCA, which describes an existing or potential supply chain, measures environmental efficiency. However, measurement of environmental compatibility in a broader sense requires consideration of the system effects of changes in economic activities. The associated tool is consequential LCA, which considers alternative uses for scarce resources, notably land in the case of biofuels (Wenzel et al. 2013), although subject to limitations in evaluating the broader consequences of macro-economic changes.

Moving to the third lobe in Fig. 1, i.e. moving from assessing environmental performance to considering sustainability, concern for "quality of life" inevitably begs the question "quality of whose life?" Applying the whole system approach to social equity within supply chains requires examination not only of the distribution of environmental impacts but also of the social and economic benefits along the supply chain, to reveal the relationship between the consumers of the products or services and the agents whose actions make up the supply chain. This contribution introduces some of the problems and possible approaches in attempting to address all three components of sustainable development in supply chains, including the shift from a production to a consumption perspective.

1.2 Production and Consumption

Some of the challenges in reducing the environmental impacts of human economic activities—for example, "decarbonising" the economy—are summed up in Fig. 2. Although there are powerful arguments that total material consumption must be reduced (e.g. Arrow et al. 2004), conventional economic thinking assumes that economic activity (as measured by Gross Domestic Product, GDP, as distinct from material consumption or energy use) will continue to increase over time. To reduce the associated environmental pressure, i.e. to achieve absolute decoupling, requires the environmental intensity of economic activity (e.g. GHG emissions per unit of GDP) to decrease more rapidly than the increase in GDP. Slower reduction in environmental intensity merely leads to relative decoupling: environmental pressure continues to grow, albeit less rapidly than GDP. There is scant evidence that absolute decoupling has ever been achieved except in limited geographical areas or industrial sectors, leading to the current active debate over whether growth in GDP can be sustainable (e.g. Victor 2008; Jackson 2009a, b; Ekins 2000, 2010).

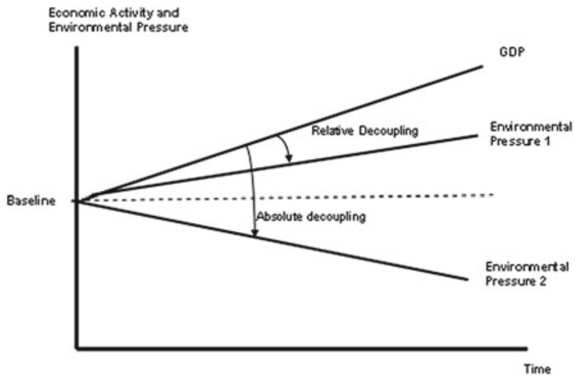

Fig. 2 Absolute and relative decoupling of environmental pressure from economic activity (schematic)

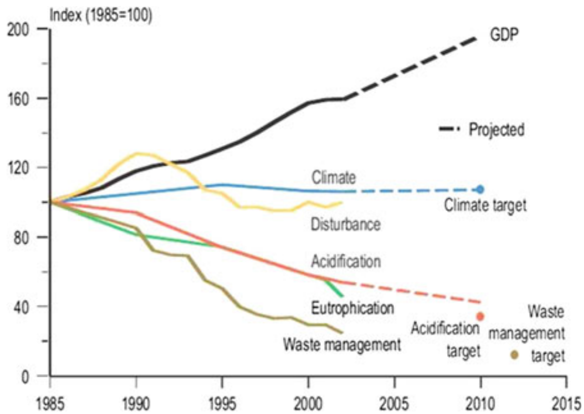

Fig. 3 Decoupling in the Netherlands: changes in GDP and environmental impact 1985–2010 (Netherlands Environmental Assessment Agency and National Institute for Public Health and the Environment 2005)

Relating environmental pressure to GDP hides a further problem, illustrated by Fig. 3 which summarises the economic and environmental performance of the Netherlands since 1985. Whilst GDP has grown rather steadily, absolute decoupling has apparently been achieved in some components of environmental pressure and emissions of greenhouse gases have been almost constant. However, this period has also seen significant restructuring of the Netherlands economy with some environmentally intensive industries migrating elsewhere. For the specific impact of climate-forcing emissions, this phenomenon is known as "carbon leakage". The key point is that a country's environmental performance can appear to improve solely because the more polluting industries in the country are closed down and their output is imported rather than produced domestically. The environmental intensity of an economy measured allowing for the environmental pressures embodied in international trade can be radically different from that measured solely by domestic economic activities (e.g. Peters and Hertwich 2008).

Current international negotiations focus on domestic or "production" accounting, which considers only domestic activities. Whether the basis should be "consumption" accounting, based on the environmental impacts of goods and services consumed in a country, is a difficult issue which is starting to be recognised in international negotiations on mitigating climate-forcing emissions. One of the approaches being considered is imposition of "border taxes", to ensure that imported goods are subject to the same costs or taxes on emissions as those produced domestically (see e.g. Ismer and Neuhoff 2007; Izard et al. 2010). While border taxes may be compatible with current rules on international trade (Ismer and Neuhoff 2007), they are unlikely to be implemented rapidly in the absence of any international agency with the authority to regulate them. There is also discussion over the principle of border taxes on the basis that the country where the emissions arise obtains the economic benefit of the activities generating the emissions. Analysis of the different stages in the supply chain, outlined below, sheds an interesting light on this discussion.

2 Sustainability of Supply Chains

2.1 Economic Benefits and Environmental Impacts

The relationship between these two concerns—the principle of equity (or environmental justice) which underlies the concept of sustainable development and the migration of polluting industries from developed to developing countries—can be clarified by examining the extent to which supply chains meet the general principles of sustainability outlined above. It is informative to examine supply chains in terms of a common type of ecometric (see Biswas et al. 1998) which represents the micro-level equivalent of the economy-wide environmental intensity introduced above. Each of the major steps in the supply chain is assessed in terms of its environmental pressure (e.g. the emissions of greenhouse gases) per unit of economic activity. Economic activity is measured by Added Value (i.e. the sales price of the outputs minus the costs of inputs, ancillaries and energy) rather than other economic metrics such as Gross Margin (which is net of labour costs) because Added Value represents the contribution of each operation in the supply chain to the GDP of the economy in which it is located.

This ecometric can be used to identify industrial sectors, products or processes associated with environmental impacts disproportionate to their economic value and therefore to be targeted for environmental improvement (Clift and Wright 2000). It is given by the gradient of the chord OA in Fig. 4 which represents the total impact per unit of economic value for a product entering use.[3] Figure 4 actually shows a section through an (N + 1) dimensional surface, with N environmental dimensions corresponding to different environmental impacts and one economic dimension. Aggregation across the impact categories, as in the

[3] Figure 4 is drawn approximately to scale but without numerical values to preserve commercial confidentiality.

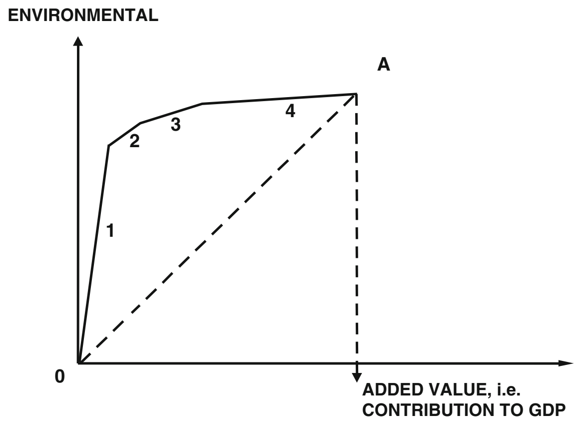

Fig. 4 Accumulation of added value (i.e. contribution to GDP) and environmental impact along supply chain for a manufactured product (Clift and Wright 2000):
1. Resource extraction;
2. Processing and refining;
3. Manufacturing; 4. Retail and distribution

Valuation phase of LCA, collapses the surface to two dimensions but loses information and can therefore be misleading.

The ecometric can also be estimated separately for the principal stages in the supply chain by combining results from LCA and value chain analysis (VCA). Figure 4 shows the form obtained for mobile telephones (Wright 1999; Clift and Wright 2000), with the supply chain broken down into resource extraction, processing and refining, manufacturing and retail and distribution.

Figure 4 is remarkable for its extreme convexity. The environmental intensity, indicated by the gradient of each segment, is very high for the initial extraction stage and reduces progressively along the supply chain: following primary extraction and materials processing, the impacts of manufacturing as well as retailing and distributing are very much lower. This feature appears to be shared by many other manufactured products, and by textiles and garments and by food products (Sim 2006; Brandão et al. 2010): typically, primary industries have low added value and disproportionately high environmental impacts, whereas distributors and retailers (and the financial sector) realise large added value with low environmental impacts (Clift and Wright 2000). This convexity has important implications (Jackson and Clift 1998; Clift and Wright 2000; Clift 2003). Applying the principle of Environmental Justice which is central to sustainability (see above), disproportionate environmental impact in part of a supply chain indicates lack of equity and therefore unsustainability in the supply chain (Clift 2003), because an operator is either suffering local environmental damage without economic compensation or causing impacts, such as climate change, affecting others without compensating for the "externalities".[4]

A further implication of Fig. 4 is that economies seeking to expand by growing their primary sectors will not generally see an economic benefit proportionate to the environmental damage. A specific recent example is provided by the political

[4] Whether taxes or charges to "internalise the externalities" would straighten out production curves like that in Fig. 4 is an interesting but unexplored question.

debate in New Zealand over proposals to re-open or expand mining in protected areas. The arguments against the proposals included the point that the direct economic value would not compensate for the damage to New Zealand's pristine "brand" image, backed up by analyses which showed relatively low levels of economic and social welfare in mining areas (Evans et al. 2009)—which in turn provides indirect support for the finding that primary industries are associated with disproportionately low added economic value.

Although Fig. 4 only covers the first cycle of use of a manufactured project, it has implications for re-use and recycling (Clift and Wright 2000). The under-valuing of primary resources acts as a strong economic disincentive to recovery and recycling or re-engineering of manufactured goods. While global carbon constraints could in principle lead to reduced emissions through comparative advantage effects (Strømman et al. 2009), in the absence of any international agency to minimise emissions (or regulate border taxes) the tendency is for the most polluting industries to move to countries with low or zero emission charges or loose regulation. When economic and environmental impacts are distributed as in Fig. 4, migration of primary industries from industrialised to developing countries transfers environmental impacts without proportionate economic benefit. From the perspective of the product, it means that the main environmental damages arise in the parts of the supply chain most remote from the end consumer.

As a further example of the information to be obtained from combining LCA and VCA, Fig. 5 shows the distribution of economic added value and emissions of greenhouse gases (GHGs) in the supply chains for fresh watercress[5] distributed to a particular chain of retail outlets in the UK (Sim 2006). In this case, the three principal stages in the supply chain are cultivation, harvesting and chilling; transport to the supplier's packaging plant; and final packaging and storage prior to transportation to the retail outlet. Watercress is sold all year round not differentiated in terms of price to the consumer (except for in-store promotions that may occur, for example when there is a glut in production) although the country of origin may be indicated. Therefore, the total added value is identical for watercress from all sources. The principal sources in Europe are two areas in Southern England (Hampshire and Dorset) and one in Southern Portugal. However, during the winter months supply from these sources is insufficient to meet demand; watercress is then brought in by air freight from the Southern USA. The economic returns to the US producer are lower than for the European producers, due to the higher cost of air transport. However, the most significant feature of the transatlantic trade, shown in Fig. 5, is an order-of-magnitude increase in GHG emissions. This illustrates one of the few points which apply with generality to the environmental impacts of supply chains: when air freight is used, it dominates (RCEP 2002; Sim et al. 2006). Put in a slightly different

[5] Watercress is a green vegetable sold mainly as a constituent of prepared salads. In this form, it has become a commodity sold all year round although it is possible to substitute it by other green vegetables when it is out of season locally.

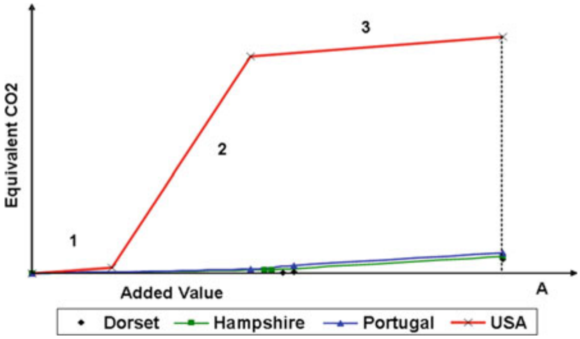

Fig. 5 Greenhouse gas emissions associated with supply of fresh watercress in the UK (from Sim 2006). 1. Cultivation, harvesting and chilling; 2. Transport to packaging plant; 3. Final packing and storage

perspective, Fig. 5 illustrates the environmental impacts which can result from year-round consumption of a seasonal product.

The supply chains for the three European sources are relatively linear, in fact slightly concave, notably free from the gross convexity of Fig. 4 which seems to characterise most product supply chains. Sim (2006) concluded that this relatively equitable distribution of impacts and economic benefits along the supply chain results from a balanced relationship between producer and retailer, arising from the fact that few other producers are capable of providing watercress to the retailer's standards. This highlights the importance of understanding not just the technological performance but also the governance of supply chains and the relationship between the different agents (Baumann 2009). This is a particular feature of food supply chains. It is well known that LCA, a tool originally developed for analysing manufacturing supply chains, has to be modified and adapted for agricultural systems. Part of the difference lies in the fact that operations in the manufacturing and processing sectors are subject to controls which mean that the performance of a technology varies rather little according to who operates it. As a specific example, the carbon efficiencies of European petroleum refineries only vary by about 25 % (Holmes 2008). By contrast, agricultural production is much more sensitive to the practices of individual operators; this is reflected in the great range of performance of different producers, even when producing the same crop in the same geographical locality. "Soft system" approaches to analysing the governance of supply chains therefore need to be combined with the "hard system" approach of LCA (Sim 2006).

2.2 *Social Benefits*

Following the three-component model of sustainable development summarised by Fig. 1, the distribution of social benefits along the supply chain must also be considered in assessing sustainability. Added value is used as the economic metric in Fig. 4 because it represents the economic return to each stage in the supply chain but this does not necessarily correlate with the social benefit to the workforce (Sim 2006). The recent UNEP/SETAC initiative (UNEP 2009) represents a first attempt to assess social benefits by incorporating them into the framework of LCA. It remains to be seen whether such a formulaic approach can provide useful information; it may be that assessment of social benefits will need to be more flexible. To take an obvious example, child labour is regarded as a feature of supply chains to be eschewed; this is a valid judgment if the alternative to child labour is education, but not obviously valid if the alternative is child prostitution or enforced military service. A more flexible approach to assessing the distribution of social benefits will also need a better understanding of the governance of supply chains, again implying a "soft systems" approach to assessment.

The importance of assessing the distribution of benefits is highlighted by a real question which arises in sustainable management of supply chains. Fresh vegetables and other produce, including cut flowers, are grown in parts of sub-Saharan Africa and air-freighted to consumers in wealthier parts of the world. The environmental impacts are large, in terms of contribution to climate change from the air freight (Sim et al. 2006) and also water use in water-stressed regions. The former represents impacts on the whole planet which are not internalised into the cost of transport, while the latter is an example of local impact which consumes a scarce resource and reduces its availability for crops for local consumption. However, if the trade were to be stopped suddenly, on the basis that the environmental impacts are unsustainable, there would be serious social and economic consequences for workers in this industry in producer countries. From the point of view of the actor controlling the supply chain, most commonly the retailer (see below), the trade might be justified in terms of an argument articulated, for example, by Cramer (2006), that the core business of a responsible company should support the development of countries from which they source products, but this would constitute a strategic purchasing decision to be taken after appropriate deliberation. An approach which might be explored is to investigate whether the social and economic benefits can legitimately be considered to outweigh the environmental impacts, provided that the benefits accrue to producers in developing countries rather than to privileged consumers in relatively affluent groups or societies. Thus recognition of the Social Equity component of sustainable development has implications for sustainable consumption which merit further exploration.

3 Sustainable Consumption and the Role of Luxury Spending

For consumers in affluent societies living at levels way above mere subsistence, consumption is determined not by needs but by disposable income (e.g. Kok et al. 2006; Lenzen et al. 2006); it would be naïve or impossibly idealistic to suggest that consumers will only spend what is necessary to meet their needs and will save or

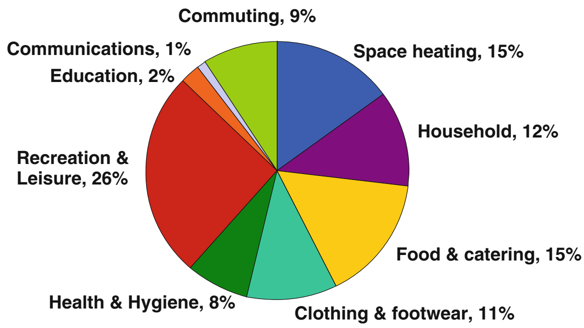

Fig. 6 Life-cycle CO_2 emissions allocated to aggregated high-level functional uses for an average UK household in 2004 (from Druckman and Jackson 2009)

give away their surplus income. Furthermore, the current economic paradigm requires consumption in order to support economic activity, demonstrated graphically by moves throughout the industrialised world to promote consumption as one of the principal tools to combat recession.

The analysis outlined here shows why sustainable consumption in the developed world needs to shift towards products which not only cause less resource use or environmental damage but also provide equitable social and economic benefits back along the supply chain. Most current efforts to influence consumer spending, such as ecolabels and "carbon footprint" labels, focus on identifying products with reduced environmental impacts and only report the overall performance—in effect, OA in Fig. 4. To give information on the distribution of impacts and benefits along the whole supply chain will require a different (and largely unexplored) approach to communication with consumers. The information imparted will inevitably be multi-dimensional and complicated and therefore not reducible to simple labels. Communication will therefore depend on retailers for implementation and its effectiveness will depend on maintaining the trust of consumers in the retailers providing this information. The enhanced role for the retailer represents further reinforcement of the trend already established by ecolabels and carbon labels (Clift et al. 2005, 2009). The beginnings of labelling for equitable economic and social benefits can be seen in the "Fair Trade" movement, whose objective is to identify and promote products which ensure a flow of economic and social benefits to the agents in the earlier stages of the supply chain. The wide acceptance of the Fair Trade movement has shown that this approach to promoting sustainable consumption can influence consumer behaviour. However, systematic empirical assessment of the benefits of Fair Trade and similar schemes appears to be lacking; at present, the movement is based on the assumption that better processes in the management of a supply chain automatically lead to more equitable outcomes.

Against this background, we can consider how a responsible consumer might direct their spending to promote sustainability by reducing the environmental impacts and improving and spreading the social benefits caused by their consumption. Figure 6, from Druckman and Jackson (2009), shows the distribution of greenhouse emissions associated with routine expenditure of an average UK household; broadly similar patterns of the impacts of household consumption have been identified for other European countries (e.g. Carlsson-Kanyama et al. 2005; Moll et al. 2005; Peters and Hertwich 2006; Hertwich 2006; Girod and de Haan 2009).

The first clear conclusion is that environmental impacts are spread across most forms of consumer spending.[6] One of the more depressing findings is that average environmental intensity differs rather little between most aggregated categories of consumer expenditure; all but the most environmentally damaging or benign forms of consumer expenditure in Europe differ by only about a factor of three in aggregated life-cycle impact per euro spent (Huppes et al. 2006; European Commission 2006). Thus there is limited scope for consumers to reduce their environmental impact by redistributing their spending between different categories of goods and services (see also Gutowski et al. 2008), although there is some scope to redirect spending from "bad" to "good" outliers. Under these circumstances, with total consumptive expenditure limited by disposable income (see above), "rebound"—the phenomenon whereby reduction in environmental impact, for example through improved technology, is countered by increases or shifts in consumption—is difficult to avoid (e.g. Hertwich 2005). To give an obvious example, money saved on "Space Heating" through improved household insulation can lead to even larger impacts if the disposable income is spent instead on recreational air travel in the "Recreation and Leisure" category.

Thus, it is generally necessary for responsible and motivated consumers to look within each category of expenditure to identify purchases with reduced environmental impact and increased social benefit per unit of expenditure. A specific example—avoiding out-of-season produce shipped by air freight—was introduced above. Changes in diet, notably to reduce consumption of meat and dairy produce, represent a more general way to reduce the impact of food consumption (e.g. Carlsson-Kanyama et al. 2005). Another, less obvious, example of consumption to be promoted rather than discouraged, purely on the basis of its contribution to sustainable development, is relatively expensive, high-quality, luxury "Fair Trade" chocolate: low impact for the expenditure, chosen because the purchase should benefit all the agents along the supply chains and, according to most tastes, an enjoyable as well as equitable form of consumption—an example of "living well within the ecological limits".

Similar arguments apply to other categories in Fig. 6, notably "Household" and "Clothing and Footwear". In these cases, more sustainable consumption is represented by durable purchases which are usually associated with relatively high initial cost, contrary to the general trend for service life to be limited by obsolescence due to unfashionability rather than loss of function (Stahel 2006; Clift and Allwood 2011). Longer service lives obviously reduce not only the environmental impacts of production but also the impacts of waste disposal. It is recognised that

[6] The relatively large contribution of "Recreation and Leisure" in Fig. 6 is due to air travel for vacations (Druckman A, 2010, personal communication), a further illustration of the disproportionate impacts of aviation noted above.

this proposal runs contrary to current social trends. For example, the fashion for cheap discardable clothing in Europe has led to a measurable increase in the proportion of textiles entering the municipal waste stream.[7] However, Girod and de Haan (2009) have explored the possibility that quality-oriented consumption can be more sustainable, specifically for Swiss households. Their empirical results show, inter alia, that "low emitters opt for higher prices while high emitters pay lower prices" and "high emitters spend a higher amount on mobility while low emitters opt for leisure" reinforcing the argument advanced here. Some companies, particularly those in the retail sector whose market niche includes perceived "quality" (e.g. Marks and Spencer 2011), are already starting to adopt sustainability as a company and product characteristic, although it is not clear whether business generally sees this as anything more fundamental than a "megatrend" (Lubin and Esty 2010).

Quality clothes and durable household goods are examples of directing consumer spending to quality goods; i.e. products and services with higher initial cost but with low environmental impact over their life cycles and high skilled labour per unit of consumer expenditure. In effect, we are advocating quality, high cost purchases with equitable supply chains as a key component of sustainable consumption. In terms of the behavioural change models identified by Tukker et al. (2010), we are advocating promoting quality as the "symbolic or identity value" guiding consumption, at least for the most affluent.

For the most affluent inhabitants of the planet, even quality purchases of essential items will not use up their disposable income. Pursuing the argument that consumption is determined not by needs but by disposable income, we therefore ask how surplus income should be spent; i.e. what principles should guide luxury spending. "Sustainable luxury" would entail purchases with low environmental impact and equitable supply chains, rather than more obviously "luxurious" purchases such as fuel-inefficient personal vehicles or air travel.

Although Alfredsson (2004) has questioned whether this approach could bring about a real reduction in the environmental impacts of consumption, Girod and de Haan (2009) argue that Alfredsson underestimates the influence of "green consumers" as role models and overestimated the "rebound" of such a shift in consumption patterns. The argument here is that, if luxury or quality purchasing were to become more widespread in affluent societies, Alfredson's argument—which is essentially that a few individual purchases are too insignificant to be influential—would become irrelevant. More demand for luxury goods would promote high-labour low-impact activities: more skilled seamstresses and fewer sweat-shops; more artists and fewer air crew.

[7] In the UK, this has become known officially as "the Primark effect" (House of Commons 2010) after a successful clothing retail chain.

We illustrate the principle of luxury consumption by a specific example: purchase of a work of art, a cast bronze sculpture—“Sarabande” by Philip Jackson. The carbon intensity of the purchase is estimated at about 0.01 kg CO_2 (eq) per € (see Appendix). This makes it clearly a “good” outlier in the range of consumer expenditure, way below the average impact for Europe, much better even than the broad categories of “education” and “health” which show the least contribution to climate change per unit of expenditure (Huppes et al. 2006). The carbon intensity is more than 100 times lower than for air travel within Europe. These figures are stark enough to justify another general conclusion: it is more sustainable to purchase works of art as luxury items than to undertake luxury travel by air to view them.

4 Concluding Remarks

To sum up, the three-component model of sustainability must be applied to complete supply chains or life cycles if the notion of sustainable consumption is to be made operational. However, much more work is needed to characterise and measure equity in supply chains. Consumer purchasing, particularly by the more affluent members of society, should be directed to expensive quality or luxury goods with low environmental impact per unit of expenditure and equitable supply chains. This interpretation of quality and luxury needs more exploration, but the message is that sustainable consumption does not necessarily require frugality; it can be consistent with a luxurious life—“living well” in both senses. Following Faiers et al. (2007), we suggest that this message could represent a way to popularise and promote the idea of sustainable consumption to the more affluent inhabitants of the planet.

In brief: angels, rather than devils, wear Prada. By contrast, no matter how well managed its supply chains, a company whose business model turns capital or durable purchases into mere consumer goods is not promoting sustainability.

5 Appendix

Estimation of Carbon Intensity of “Sarabande”

The statue of Sarabande, by Philip Jackson, is cast bronze, weighing about 200 kg. Carbon dioxide emissions for primary metal production are taken as 2.63 kg per kg bronze (Ecoinvent 2009). Therefore the GHG emissions embodied in the metal are about 525 kg CO_2 eq. This figure is conservative, because it assumes that virgin metal only is used.

The energy required to cast bronze is assumed to be similar to the latent heat of fusion of Copper, about 205 kJ/kg (Engineering Toolbox 2010). Assuming that gas is used as fuel in the foundry with 60 % efficiency of energy transfer to the metal, and that the greenhouse gas emissions over supply and use are 0.053 kg CO_2 eq/MJ, the emissions associated with melting 200 kg of bronze are

$$200 \times 205 \times 0.053/(0.6 \times 1000)\,\mathrm{kg\,CO_2\,eq} = 3.62\,\mathrm{kg\,CO_2\,eq}$$

Therefore the total GHG emissions associated with producing Sarabande are approx 525 + 4 = 529 kg CO_2 eq, about 530 kg CO_2 eq. Note that this figure is dominated by the metal with relatively small contribution from the casting process. Transport and installation will be small by comparison and have therefore been ignored. The embodied energy would therefore not be lost if some barbarian decided to fashion the bronze into something else.

With a purchase price of nearly £40,000, the GHG intensity of the purchase is

$$530/4 \times 10^4 = 0.013\,\mathrm{kg\,CO_2\,eq\ per\ £}$$

For comparison, a return flight from London to Gothenburg, a typical distance for a flight within Europe, costs typically £120 (fare plus taxes and fuel surcharge) and the associated carbon dioxide emissions are 273 kg per passenger (SAS 2010), roughly half the emissions associated with making Sarabande and corresponding to 2.3 kg CO_2 eq per £ spent. The type of aircraft on this route (MD82) is relatively old and fuel-inefficient. However, there is an argument that the radiative forcing should be estimated allowing for other effects, such as condensation trails, by multiplying the carbon dioxide emissions by a factor approaching 3 (RCEP 2002). This figure also puts the flight slightly below the average figure estimated by Huppes et al. (2006) for private transport, which is to be expected since the climate impacts for air travel are somewhat less than those for a single passenger in a typical gasoline-powered car (RCEP 2002). Furthermore, the estimates by Huppes et al. were obtained by input/output analysis so that exact agreement with process-based LCA figures derived here cannot be expected. In fact, the consistency is remarkably good. We therefore retain the simple estimate for the current aircraft.

The figures for environmental intensity, based on currency exchange rates at January 2010, are:

kg CO_2 per	£	€	$
Sarabande	0.013	0.01	0.008
London–Gothenburg	2.3	2.0	1.4

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